Prof. W. H. Niles

With the Compliments of
Verplanck Colvin.

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STATE OF NEW YORK.

REPORT

ON THE

TOPOGRAPHICAL SURVEY

OF THE

Adirondack Wilderness of New York,

FOR THE YEAR 1873.

BY

VERPLANCK COLVIN.

TRANSMITTED TO THE LEGISLATURE APRIL 21, 1874.

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STATE OF NEW YORK.

No. 98.

IN SENATE,

April 21, 1874.

To Hon. John C. Robinson,

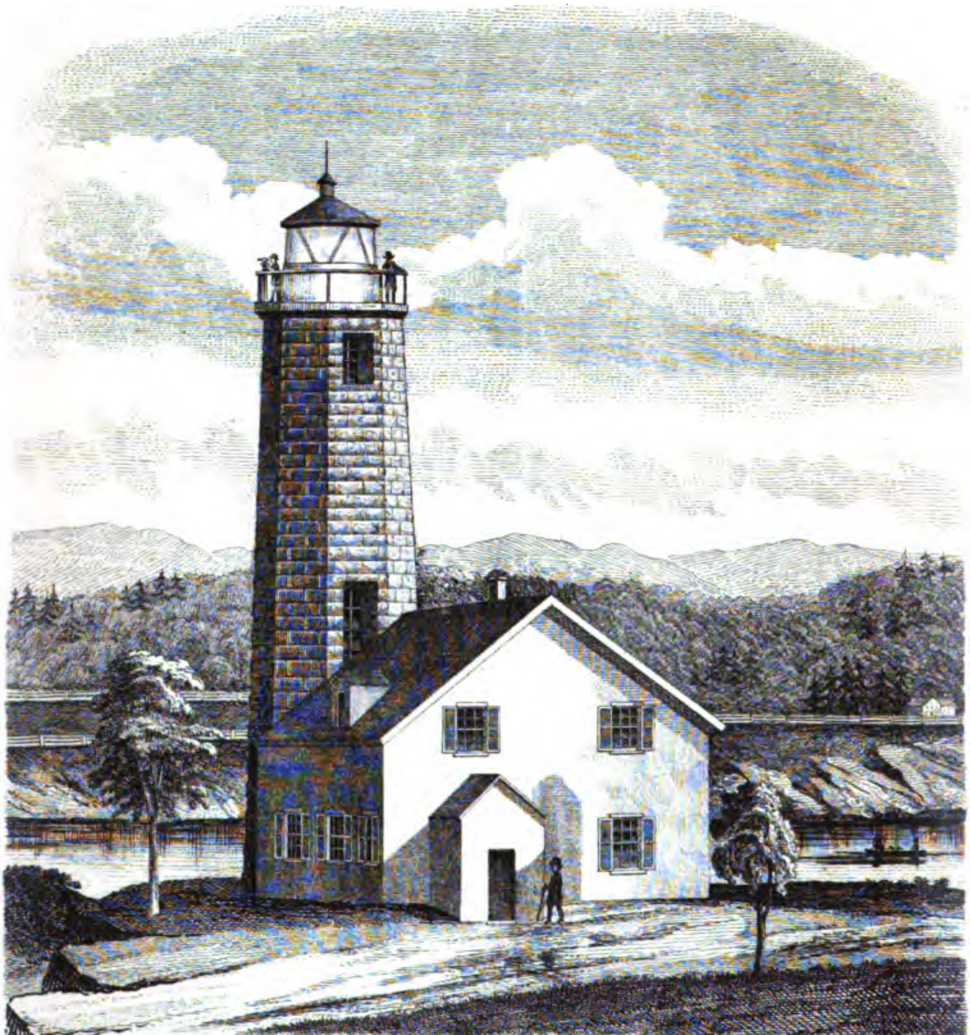
Lieutenant-Governor and President of the Senate:

Sir — Pursuant to a provision contained in chapter 733 of the laws of 1872, to aid in completing a topographical survey of the Adirondack wilderness of New York, I have the honor to submit the accompanying report to the legislature.

Very respectfully yours,
VERPLANCK COLVIN.

Late Note. — Owing to my recent measurement of the height of the Dudley Observatory (made since the maps, accompanying this report, were printed, by which it is found to be higher than recorded in the Annals of that Institution), the altitudes shown upon the maps — plates 6, 11, 19 and 20 — are all based upon a datum $36\frac{4}{10}$ feet above mean tide level in the Hudson river at Albany. See Appendix B, p. 177. The publication of the report has been delayed in order to correct the altitudes throughout the stereotype to tide level.

Errata. — See description of this map in Appendix A.


Drawn by Verplanck Colvin. Wied. Parsons & Co. Lith.

STATION, CROWN POINT LIGHT HOUSE.

REPORT.

To the Honorable the Legislature of the State of New York:

In accordance with law, I have the honor to submit, accompanied with maps and illustrations, the following

REPORT.

The operations of the Adirondack Survey, as at present progressing, cover, to a greater or less extent, from three to five thousand square miles of the wilderness region of northern New York. While the method of map sketching in the field gives it the character of a military topographical reconnaissance, it is essentially a geodetical survey, the greater measurements being trigonometrical; a vast and intricate system of triangles having been extended over the interior of the wilderness. In this respect the work is independent of any of the previous partial and inaccurate compass surveys; and having been connected with the great geodetical work of the United States Coast Survey, at numerous points during the season, the region has now for the first time been placed on maps in true proportional geodetical connection with the rest of the world — forming the first trigonometrical survey of any portion of New York under legislative assistance and authority.

The survey was originally an exploration and topographical reconnaissance of our great wilderness for the purpose of obtaining a correct map thereof, and was undertaken and carried on at my own expense. It became, through an appropriation of the state in 1872, so far connected with the state government, that in return for the appropriation, "a full and complete report" was required to be made to the legislature on the progress of the survey. While endeavoring to make as full and complete a report as the law seemed to require, I have not thought it advisable to append hereto the whole vast number of topographical sketches and reconnaissance maps executed in the field during the past season; a sufficient number, only, of illustrations being given to render intelligible the nature, method, progress, and difficulties of the work.

The popular demand that has arisen throughout the state for more complete and accurate information in regard to this wonderful wilderness region, probably owes its origin to the general enthusiasm for the proposed state or Adirondack park. This, while it will afford a perpetual and refreshing summer resort for our people, and a vast natural and healthful pleasure ground for our youth — who will in toilsome

hunting expeditions and wilderness marches acquire that skill and endurance which in war will make them the bulwark of the state — will, at the same time, by the preservation of the timber and the conservation of the waters, secure to the state vastly increased wealth, importance and power. I shall hereafter show that the practical continuance of the canals, or their enlargement for shipping purposes, whether it be the Erie, the Champlain, or the Black River, depends in the future, as it does almost entirely at present on the numerous rivers of the wilderness; and there is not a builder, or a farmer throughout the state but is interested in preserving from fire and destruction the vast forest which covers from three to five thousand square miles of northern New York, and which in the future will be the only source within our boundaries, whence he may hope to obtain a cheap supply of lumber.

It is this great popular interest which has urged on this survey, and has compelled it to assume proportions I had hardly contemplated. With a desire to accomplish the will of the people, I have prepared the following, principally in the narrative form, in which my previous report was rendered — the regular form in which reports on explorations are made—and have endeavored to divest the account of field work of all unnecessary technicality, in order that the course of the work may be readily and easily followed.

Few fully understand what the Adirondack wilderness really is. It is a mystery even to those who have crossed and recrossed it by boats along its avenues, the lakes; and on foot through its vast and silent recesses, by following the long ghastly lines of blazed or axe-marked trees, which the daring searcher for the fur of the sable or the mink, has chopped in order that he may find his way again in that deep and often desolate forest. In these remote sections, filled with the most rugged mountains, where unnamed waterfalls pour in snowy tresses from the dark overhanging cliffs, the horse can find no footing; and the adventurous trapper or explorer must carry upon his back his blankets and a heavy stock of food. His rifle, which affords protection against wild beasts, at times replenishes his well husbanded provisions, and his axe aids him in constructing from bark or bough some temporary shelter from storm, or hews into logs the huge trees which form the fierce, roaring, comfortable fire of the camp. Yet, though the woodsman may pass his life-time in some section of the wilderness it is still a mystery to him. Following the line of axe-marks upon the trees; venturing along the cliff walls of the streams which rush leap on leap downward to form haughty rivers; climbing on the steep wooded slopes of lakes which never knew form or name on maps, he clings to his trapping line, and shrouded and shut in by the deep, wonderful forest, emerges at length from its darkness to the daylight of the clearings, like a man who has passed under a great river or arm of the sea through a tunnel, knowing little of the wonders that had surrounded him.

It is a peculiar region; for though the geographical center of the wilderness may be readily and easily reached in the light canoe-like boats of the guides, by lakes and rivers, which form a labyrinth of passages for boats; the core, or rather cores, of this wilderness extend on either hand from these broad avenues of water, and in their interior remain to-day spots as untrodden by man, and as unknown

and wild, as when the Indian alone paddled his birchen boat upon those streams and lakes. Amid these mountain solitudes are places at this moment where, in all probability, the foot of man never trod; and here the panther has his den among the rocks, and rears his savage kittens undisturbed save by the growl of bear or screech of lynx, or the hoarse croak of raven taking its share of the carcass of slain deer. Of this region, for a hundred years or more, civilized man has held the most diverse opinions. Since the first settlement of New York there have been constant endeavors to clear and cultivate it, and crumbling buildings upon its margin, here and there, are records of wasted effort, squandered capital, and ruin. These unfortunate attempts at settlement originated in wild and false statements made by land speculators as to the richness and fertility of the region, supported by the specious argument that it must be fertile and valuable because lands on the St. Lawrence river, further north, even in Canada, were fruitful and productive. All this trouble, all this wasted labor, and confusion, can be directly traced to the low state of knowledge of the physical sciences in those days, and the absolute ignorance which then existed, and has existed up to a recent period, of the *science of the atmosphere* and of climatology. The people of those days did not know that, practically, in agriculture, every thousand feet of elevation was equivalent in climate to one or two degrees of north latitude;* or, more plainly, that if the lands of a market gardener near New York city were suddenly raised 5,000 feet he would find himself in a climate like that of Montreal, Canada, the spring perhaps a month or more later in coming, and winter like that of Labrador. When we now come to consider that this great wilderness extends from two hundred to three hundred miles north of New York, and that of its area two or three thousand square miles, are so elevated that the lake and river levels have an altitude of 1,500 or 1,800 or 2,000 feet above the sea, and that some of the smaller lakelets, rising to 4,000 feet, are hemmed in by mountains exceeding 5,000 feet in altitude, we readily perceive that this whole region must have a peculiar climate and more severe than that of the lowlands of the same latitude which are nearer to the level of the sea. In such a region, therefore, the height of lands above tide level becomes a measure of their climate, and consequently of their value for agricultural purposes, and thus the hypsometrical work of this survey — every height, indeed, above sea level that is determined — becomes of practical value to the farmer or cultivator, the purchaser of lands for agricultural purposes, or the political economist who desires to estimate the capacity of the state, or a portion of it, for the production of food.

Thus the barometer, which in its early days was only an instrument of abstract science, has come to be practically valuable in another branch of human industry, showing where money and labor would be wasted, in vain efforts by the agriculturist.

In my report of last year, a portion of which is placed as an appendix to this report, I explained the unreliable state of information existing in relation to this region which rendered the present survey necessary. It may not be improper to state here, before proceeding with the account of the progress of the work, that from the erroneous

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* For this region: see conclusion.

character of the existing maps, which often show a level where there are really towering mountains, or swamps or lakes; worthless lands are given an appearance of value, and valuable lands depreciated, and men become confused by the conflicting appearances.

With the theodolite and transit we have, by our triangulation, carefully eliminated some of the most important of these errors; determining, for the first time, by a net work of triangles and great quadrilaterals the relative positions of the great mountain landmarks, which will remain unchanged through countless centuries, little affected by the frost of winter or the heats of summer.

Ten centuries hence the surveyor who may desire to find the location of some place or point which has been lost; will have only to turn to our triangulation, and repeat the recorded measurements from those peaks, to find the desired point.

There are numberless considerations which make our careful measurements of great importance. The necessity for such constant nicety and exactness in the angular measurements and leveling are too well known to engineers accustomed to the practice of higher surveying, to require explanation here.

INSTRUMENTS.

The principal instruments used during the past season in executing the field work were as follows:

Theodolite A. Made by Troughton & Simms of London, being the same as used last season. It has a vertical arc, and six-inch horizontal limb, with double verniers.

Theodolite B. Made by J. Kern of Aarau (Suisse); nine-inch horizontal limb, with double verniers. It has also a vertical arc.

Theodolite C. Made by W. Würdemann, Washington; has a seven-inch horizontal limb and a small vertical limb.

The sextant was the same used last season and, as heretofore, was found of great value in measurements on the interior lakes of the wilderness, and was useful with artificial horizon in occasional determination of latitude.

The *Azimuth compass* was extremely useful in the rapid reconnaissance of new lakes, and in general topographical mapping. Its portability and the readiness with which, even in a canoe, readings could be taken without moving the eye from the instrument, made it especially valuable. A light compass, with telescope mountings and tripod was useful for the men employed in short reconnaissance; and a dipping needle with level, enabled us to investigate isoclinal magnetism, and also local attraction or other magnetic disturbance when advisable. The leveling being confined to the superior altitudes, was executed with *mercurial mountain barometers,* made by James Green of New York, especially for this work. They were inclosed in double cases of wood, and heavy leather, and hung like a rifle from the shoulder. Carrying the instrument in this manner, and keeping one hand to lift or steady it, when climbing over fallen timber or amid rocks, it may with constant care be transported without injury to the delicate glass tubing within. The large detached thermometers, made by James Green, were also inclosed in wooden and leathern boxes, and were strapped on the outside of the barometer cases. Extra tubes in wooden cases,

and an iron bottle of quick silver, etc., were also carried for repair of instruments.

Our leveling was so nearly connected with meteorology, that preparations were made to keep an account of the maximum and minimum temperature of day and night, and superior recording instruments made by James Green were provided for this purpose.

The *maximum thermometer* was a mercurial instrument with contracted stem and horizontal movement of quicksilver.

The *minimum instrument* was a spirit thermometer (colorless), with horizontal automatic movement of glass recorder or beaded slide.

The instrument was twelve inches in length, and its range was such as to enable it to record a temperature below the freezing point of mercury. With this instrument, which I designed placing on the summit of Mount Marcy, it was hoped that the lowest temperature of the coming winter of 1873 and 1874 would be recorded, and the first determination made of the lowest winter temperature of New York.

Two *Aneroid barometers* were also placed in the field; one being the large instrument of my own — which was unfortunately broken by an assistant — and another one, more portable; which was of constant use to us as a weather guide, showing at any time of day or night — without adjustment — the approximate change of atmospheric pressure. Both instruments were compensated for temperature. The large superior one was an R. & J. Beck instrument, and the smaller one was made by Pitkin of London, for James Green. They were not employed in the measurement of heights, but were otherwise very useful.

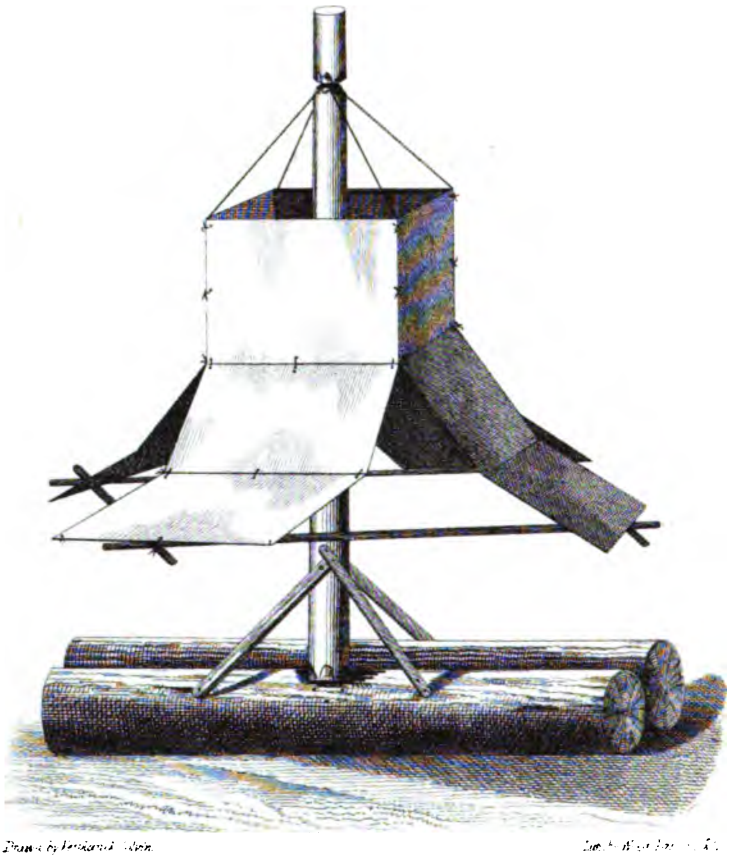
During the first half of the season, we were some days entirely driven from our work by violent gales — or hurricanes — sweeping the summits of the mountains; and on the last expedition, we carried with us a portable anemometer, being determined, if no other work should at such times be possible, to measure the velocity of these singularly violent mountain hurricanes.

Besides superintending the repairs of instruments in New York and Troy (where many special improvements in them which I had planned and drawn, were well executed by the skillful makers; subsequently enabling us to do more and better work with them), I personally directed the preparation of the camp equipage, especially strong canvas knapsacks for the transit boxes and provision carrying and map cases, special field books for triangulation, notes, etc., etc., which, with the selection of the more common outfit — utensils and clothing — camp blankets and waterproofs, all required time. I also had constructed a canvas boat of my own invention for use in the interior of the wilderness, on such of the mountain lakes as were inaccessible to boats and which it would be necessary to map. This boat was peculiar; no more frame being needed than could be readily cut in thirty minutes in the first thicket. It was twelve feet long, with thin sheet brass prows riveted on, and so fitted as to receive the keelson, prow pieces and ribs (of boughs), when required; the canvas being made water-proof, with pure rubber gum dissolved in naphtha rubbed into it. This camp equipage, however, was not to be used till August (in the second or wilderness expedition), and the boat with its coating of rubber was stretched out and left to dry. Many of the other wilderness equipments, also, were in process of manufacture during our absence upon the first expedition.

SIGNALS.

In a geodetic survey, or in any extensive triangulation, it becomes necessary to mark the survey stations by permanent signals, which shall be visible from other new and distant stations as the work advances. In the British Ordnance survey, the dazzling bude or calcium light has been employed with wonderful success in the direct measurement of the great triangles, the light being distinctly visible at the distance of sixty-seven miles, even in hazy, boisterous weather. The use of this light, however, demands the presence of at least one signal man at each station where it is employed, and though very desirable, was beyond our means. I therefore resolved to entirely dispense with such night signaling on this survey, and for very distant stations use the heliostat or mirror signal, by which the reflected light of the sun could be flashed to the surveyor, and enable him to distinguish it at points many miles distant in the great forest or on the mountain summits of the wilderness. Yet so numerous and distant were the stations where we would need such signals constantly for reference as we proceeded with the work, that after estimating their number, and the men required to attend them, and weighing the difficulty of keeping men at their posts daily through storm or shine, while we were six or seven days' journey from them in the forest, and without means of communication, I became convinced that unless some cheap automatic signal could be invented, to replace the signal men at permanent signal stations, there was great danger of the failure of the survey in executing the work proposed. I therefore, while pressing forward other preparations, gave my spare time to an experimental search for the proper signal.

A helio or sun-reflecting signal was evidently the desideratum. Glassware — silvered tubing or globes — were too fragile. Tin being cheap, and not so liable to be stolen, was evidently the most available reflector. The cones of bright tin which we had used the last season had answered admirably on comparatively short ranges, but their convex form, while always reflecting light in numberless directions, necessarily so dispersed it as to diminish its intensity and value. A very large cone or wheel-like disk of tin would have its reflecting surface far beyond the center, and would therefore be worthless. Imagining that a vibrating structure of a dozen or more stiff sheets of new tin, set at different angles and revolving under the influence of the wind, would give good results and flash in every direction as brilliantly as the facets of a jewel, I constructed such a signal and felt sure that it would answer. In order to determine practically its value, I conveyed the signal to the summit of the Helderbergh mountains, a dozen miles south-west of Albany, and suspended it by wire around a small tree, while, taking advantage of the opportunity, other helio signals were tested, and an assistant stationed near Albany answered our signals with vivid mirror flashes. On my return from the Helderberghs I found the automatic signal, which I had left on the summit, distinctly visible from the city, affording a constant and bright, star-like glimmer of light. The success of the invention being assured, the material for a sufficient number of the new signals for the primary stations was procured. These were made, for portability and cheapness, of twelve sheets of heavy new tin, 14 by 20 inches. Each sheet was kept a plane,



Drawn by [illegible] [illegible]

AUTOMATIC SIGNAL
STAN-HELIO.

Constructed of twelve sheets of tin framed together and swung [illegible]
It has been found to be visible twenty miles on a [illegible] day

and three of them fastened together with wire, longitudinally, made one side of a signal. The form finally adopted is shown in the accompanying illustration. Of any one side, the uppermost sheet is vertical (90°), the four top sheets forming a square; the second or middle sheet is generally inclined at an angle of 50° to 60°; and the lower sheet is made to take an angle of 10° or 20° above a horizontal line. By holes punched in the edge of the tin the sheets are readily linked together by wire where they are set up; and wires passing from the upper corners of the signal suspend it from a loose wire or metal collar which encircles the upholding central post at a point where it has a circular notch. Being thus loosely swung, and supported by a light wooden framework, it is constantly in motion with every gust of wind that sweeps a mountain summit; throwing steadily, in every conceivable direction, the most brilliant gleams of light. It has proved a wonderful success, having been visible to the naked eye at a distance of twenty-one miles. Without its aid we should have been unable to have accomplished our work. To this automatic reflector I have given the name of *Stan-helio signal,* and I take pleasure in introducing it into topographical engineering. Mirrors might have been substituted for the tin; but they would probably have been broken in carrying, or certainly have fallen shattered before the first heavy hailstorm, or been fractured by the swaying of the signal, in a gale, against its support.

Of these Stan-helio signals there were different orders:

The first order is a signal composed of twelve sheets of heavy tin, each 14 by 20 inches; having together, as reflecting surface, 3,360 square inches. This signal, when folded together and packed for carrying, occupied a space of only 52½ cubic inches, and weighs eleven pounds and ten ounces.

Second order signal is constructed of nine sheets of tin, 14 by 20 inches; reflecting surface, 2,520 inches.

Third order signal is constructed of twelve sheets of tin, each 10 by 14 inches; having a reflecting surface of 1,680 square inches; weight, 5 pounds 13 ounces.

Fourth order signal is made of the same sized tin as those of the third order, but of only nine sheets, being like the second order, triangular at the top.

Fifth order consisted of two double truncated tin cones; one inverted and the other upright, united at the base, and suspended by wires above the station.

Sixth order consisted of small, simple, single cones of bright tin.

Four heliostat (mirror) signals were also prepared for the use of the assistants, signal men in the direct work. The backs of the mirrors were packed with woolen, which unfortunately availed little; all the original glasses being broken before a week or two of field work had passed. The heliostats were firmly mounted, and were arranged to have been used from tripods, but the tripods proved an impediment and were abandoned. These signals, properly used by intelligent men, are the most powerful that can be employed for day work, and are visible at almost incredible distances. In smoky weather they have been brilliantly visible to us with the naked eye when thirty-two miles distant,—when the mountains themselves were invisible,—and readily measured upon with theodolite. They are distinguishable in favorable weather even sixty or seventy miles or more, but on such long ranges

it becomes necessary to use the greatest judgment in directing the flash. At these distant stations a good rifleman, when made thoroughly acquainted with the use of the heliostat, will make the best signal man. He must determine with nicety the exact direction of the distant station, and direct the flash with precision along the line found. His work, indeed, resembles the sighting of a rifle whose projectile is uninfluenced by gravity, and which rushes on into space along the line on which it has been started. The tremble of a nerve in sighting such a weapon, while it would cause but slight divergence at ordinary rifle range, would, at a distance of miles, throw it entirely off the line. Nevertheless, in the hands of my assistants, the heliostat has proved very useful at distances of from ten to thirty miles.

The only night signal which I admitted for use in exploration was the *tripod rocket*, having each a weight of from 4 ounces to a pound. Several cases of these were provided and proved useful in signaling the position of stations on the shores of unlocated, hidden lakes in the lowland forests on the western side of the wilderness.

The ordinary black and white signal flags were also used when required.

As some of the permanent automatic signals which we erected near the settlements were destroyed, either thoughtlessly or maliciously, by persons visiting the mountain tops, where they were placed; signal cards in the following form were printed and placed upon the signal posts:

S. N. Y.

ADIRONDACK SURVEY

SIGNAL STATION.

Do not Disturb this Signal.

In the exploration of lowland forests of the western portion of the wilderness a system of signals by pistol and rifle shots was adopted by which special orders were issued to the men at distant stations. A certain number of shots, rapidly fired, directing the assistant at barometer to discontinue work, or the guides to bring up boats, or to assemble for camping, etc. This was extremely useful.

STATION MARKS.

Permanent station marks were left at the corners of the more important primary triangles, in order to show the place of the theodolite,

in case further measurements shall be needed by this or another survey. The usual copper bolts were employed and were driven into holes drilled in the rock and the instrument afterward centered over them. At most of the stations on peaks other holes were drilled to hold the feet of the theodolite tripod. The surveyor desiring to avail himself of our work, and proceed from these stations for local measurements, will find it to his advantage to set his tripod by these *foot holes*, his instrument being almost instantly centered. As mentioned in last year's report, only four stations were, in 1872, marked by copper bolts. During the season of 1873, just passed, owing to the vastly increased amount of work, ten additional bolts were sunk at new and equally important mountain summit stations. The new stations thus marked are as follows:

Bolt No. 6* in the summit of Mount Discovery in Essex county.

Bolt No. 7 is in the summit of Raven Hill, near Elizabethtown.

Bolt No. 8 is in the summit of Mount Hurricane, of the Jay range.

Bolt No. 9 is in the summit of Hopkins' Peak, near Keene.

Bolt No. 10 is in the summit of Mount Dix, in the eastern range.

Bolt No. 11 is in the summit of Mount Haystack, near Mount Marcy.

Bolt No. 12 is in the summit of Mount MacIntyre, to the east of the Indian Pass.

Bolt No. 13 is in the summit of Ampersand mountain, formerly known as Moose mountain.

Bolt No. 14 is in the summit of Blue Mountain or Mount Emmons, at the north end of the crest in the center of the extensive clearing which was made for our survey purposes.

Bolt No. 15 is in the south-west corner of the rock summit of Grave's mountain, which was the most available station for the theodolite.

The copper bolts used this season were smaller and lighter than those used during the previous year, and were inscribed with letters cut in the copper, much as shown in accompanying figure.

* The locations of bolts No. 1 to No. 5 inclusive, are give on page 267.

ASSISTANTS.

During the season, five gentlemen gave their assistance in the work of surveying, and their aid enabled me to so divide the labor that with different parties at distant stations the survey progressed more rapidly. Three of the assistants, Messrs. James, Blake and Prescott had previously been engaged upon the survey. Mr. J. H. Manning gave valuable assistance in the work of the first and second divisions, and Mr. W. D. Goeway assisted at the signal station on Bald Peak, Essex county. Mr. James assisted in the measurement of the Bald Peak primary triangle, and later in the season Mr. Prescott, had charge of the signals at the same station. Mr. Blake continued his services throughout the whole season, and in charge of the advance parties, near Long Lake, at Blue mountain, etc., successfully prepared the way for the survey party. Numerous other subordinate signal parties of guides or hunters, hired and sent in advance to set-up automatic signals, did good service. The more important measurements with theodolite, transit, or barometer, etc., were made by myself. All reconnaissance maps, map sketches, illustrations, in short, all the topographical and angular mapping, except one plane-table reconnaissance sketch, were also solely my own work.

GUIDES.

The men employed during the season as *guides* and *packmen* in the labor on the different divisions, numbered fifty-one, all told. Being generally skillful hunters and trappers, their pursuits had led them along the streams and lakes where their game most abounded; and their general skill as woodsmen, made their assistance valuable, even in those sections with which they were unacquainted. Each carried upon his back a load of provisions, blankets, and camp equipage, weighing from fifty to sixty pounds. It was their duty also to build huts or shanties for the survey party, cut timber, build and keep up camp fires during the night, act as cooks, and perform such other labor as was necessary. It is not too much to say, that almost all of them were faithful, intelligent, and skillful men, ready to labor night and day for the success of the survey. Besides the regular guides, there were *teamsters, boatmen* and others, engaged in assisting the survey party, which make the total number of employees during the season, some ninety-seven or nearly one hundred men.

PLAN OF FIELD WORK.

The field work during the season was arranged in three general divisions, viz.: *First division.* The angular measurements at different points along the shores of Lake Champlain, near the meridian, 73° 30′ west of Greenwich, and between latitudes 44° and 44° 40′ north, at the different light-houses and base lines, the position or termini of which the United States Coast Survey have determined to the decimal part of a second of latitude and longitude. The base lines, and the distances between light-houses were thus to be used as the base lines of the Adirondack triangulation; the angles between these lines and the summit of such of the eastern Adirondack peaks as were visible, measured from numerous Coast Survey stations, thus permanently fixing the geographical

positions of those peaks, which, once determined, we could afterward ascend and obtain a view of the whole great panorama of the eastern or first range of the Adirondack mountains. Then, measuring the angular distance between those summits from the different mountain-peak stations previously found, a multitude of other points could, from these elevated, advantageous stations, be determined, which, in their turn — as we, in our other expeditions, advanced into the wilderness — would serve as even more advantageous stations for the location, by measurement, of the interior mountains, and of the lakes and rivers visible from them. Thus the beautifully exact work of the Coast Survey, the base lines and astronomical coördinates of their lake shore stations, furnished to the Adirondack survey by them, would enable us to determine, by our work, the latitude and longitude even of obscure and remote stations in the wilderness, and render our labors more practical by affording an accurate basis, with the aid of which all our accumulated measurements could finally be computed into distances, and not merely the local form of the region be ascertained, but its geographical relation to the world at large.

Second Division. This primary work along Lake Champlain accomplished,— after a return to headquarters at Albany, for refitting with camp equipage for wilderness work, the second expedition was to be made,— having for its object the continuation of the work from the settlements into the wilderness, the completion of connection of *last year's work* with coast survey stations on Lake Champlain, the measurement of altitude of the principal great mountains remaining unmeasured after last year's work, the continuation and completion of reconnaisance at various points, and the advancement of the survey west and south-westward over sections as yet topographically unsurveyed. Besides the main party, a subordinate signal party, in charge of two assistants, was organized to remain near the coast survey stations on Lake Champlain to work signals — heliostat — for use of trigonometrical party on the interior mountains. The main party was so organized and equipped as to admit of the detachment of the other assistants, with guides and men, on special duty, as required, and as hereafter narrated.

Third Division. The work outlined for the two preceding expeditions, if faithfully carried out, would form the foundation for the advancing of the triangulation and topographical reconnaissance north and north-westward, it was hoped, as far as the sources of the Oswegatchie river. Very favorable weather might afford us time to afterward return to and make hydrographical reconnaissance of the Saranac and St. Regis lake systems. But the principal work in this expedition was to be the exploration of the distant, remote and inaccessible region in the neighborhoood of the headwaters of the Bog river, Beaver river, and Oswegatchie.

Thus the surveyor and skillful woodsman will observe that the work on the first division, being conducted during the heated term — in July — along Lake Champlain and near the settlements, where conveyance by team or boat could in many cases be had, the strength of the command was husbanded, and, by choosing this period for a work which had at some time during the season to be executed, the hard marches and mountain climbing were reserved until the cooler weather of August, and the annoyance of mosquitoes and other

poisonous insects, whose multitude in the early summer makes the wilderness almost unendurable, was avoided.

The personal exploration of the remote and unknown sections was reserved for the last of my labors, for the reason that it was desirable to first complete all the measurements with theodolite and transit, from the mountain summits and stations while the weather remained clear, and before the mountain peaks were reached by the early autumn snows; for, while exploration on foot, through mountain passes, up streams, down valleys, and from lake to lake, may be carried on even during storms and dark, lowering weather, angular measurements from peaks — where the range from station to station is often twenty miles, and sometimes fifty or sixty miles — can only be successfully carried on in perfectly clear and calm weather; the appearance of a cloud at the horizon being often as startling as is the first appearance to the general on battle field, of reinforcements for his foe.

FIELD WORK.

FIRST DIVISION.

Trigonometrical work along Lake Champlain and its vicinity.

The long and tedious work of preparation being at length completed; the instruments and equipments for the class of work which was now to be undertaken being provided and in complete order, on the morning of July 12, I left Albany, accompanied by four assistants, carrying carefully by hand the barometers, theodolites, and other delicate instruments.

It was my intention to commence the work by the careful measurement of a great primary triangle, near Port Henry, on Lake Champlain, of which the base would be the distance between the center of the light-house on Crown Point, and the center of the light-house on Barber's Point, the distance between those points having been determined to the decimal part of a metre by the United States Coast Survey.

Reaching Port Henry, on Lake Champlain the same afternoon, I detached three of the assistants for duty at the stations near Port Henry, leaving with them two theodolites and appropriate signals. It was desirable that the value of rockets for night signaling should be determined, and I therefore directed that at 9 P. M. three of these tripod rockets should be sent up at Crown Point by the assistants left at Port Henry, designing myself to be at Mineville, on the elevated plateau commanding a view of Crown Point and of the lake, affording an excellent opportunity to ascertain the altitude to which the rockets would rise and their degree of visibility and value for our purposes in the future. Accompanied by one assistant I proceeded directly to Mineville, in order to be in readiness for the ascent of Bald Peak upon the following day. Mineville afforded no hotel, and we were indebted to a gentleman resident of the place for hospitality, and many courtesies, for which we here tender him our thanks.

At the appointed hour a sudden distant streak of fire on Crown Point severed the darkness, and the bursting rocket proved that the assistants were prompt at their work.

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The height to which the rocket rose and its degree of visibility, as determined by our observations, indicated that they would be unavailable for signaling amid the mountains, but that they might be useful in the preliminary reconnaissance of lakes in the comparatively level regions forming the western portion of the Adirondack wilderness.

July 13 proved bright and clear. Having secured the services of two men for axe-work and pack carrying, we proceeded to the foot of Bald Peak; the weather being quite hot and this the first mountain ascent of the season. The summit being achieved, the instruments were placed, and the axe-men proceeded to level such of the trees as still obstructed the view, either of Barbers's Point light-house — which far below seemed like a speck at the water's edge — or of the prospect northwestward, where some mountains, though their peaks were visible, were still so much obscured as to be difficult of identification. Thus engaged we anxiously awaited the flash of the mirror signals from the appointed lake shore stations, and waited till past noon ere there was any appearance. A shout from one of the men at length announced a signal visible on Crown Point, and our eyes were greeted by the flashing, glittering spot, which was the station of the assistant. The signal conveyed the unwelcome intelligence that Crown Point light was not visible from the Barber's Point light-house, a wooded promontory on the Vermont shore intervening. As these two light-houses were the only data so far furnished us by the Coast Survey, there was no zero for angular measurement, and consequently no means of here connecting our work with that of the coast survey, No useful change of station of survey parties could for the day be effected, and as yet we had received no signal from the Barber Point station. The remaining time was therefore devoted to topographical work and magnetic observations.

Though we waited till late in the afternoon upon the summit, no signal was received from the party at Barber's Point. Having brought with us the necessary material for a stan-helio signal of the first order, the timber for its support and framework was cut and drawn to the station by the men, and, the work being completed, it was placed directly over the copper bolt which was sunk in the rock last season. The reflecting surface consisted of twelve sheets of heavy tin, 14 x 20 inches. The clouds of mosquitoes which attacked us as we entered the forest on the sides of the mountain, were an assurance of the approach of evening, and we made a hurried descent. Troubled by the phase which affairs had assumed, I determined to return alone on the morrow to Port Henry to examine into the difficulty and to personally superintend the work going on at the lake shore stations. Accordingly, on the 14th instant, leaving one assistant at Mineville, with orders to return again with mirror signal to the Bald Peak station, I proceeded rapidly to Port Henry, and put the other assistants everywhere in motion. Sending two with theodolites by boat to Crown Point, I procured a team, and, with the other assistant and the large theodolite, drove immediately to Barber's Point light-house. The weather, which had become lowering, now threatened to render present work impossible, and soon heavy rain descended, and, as our vehicle was an open one, ourselves and instruments would have been drenched but for the rubber coats and ponchos which had fortunately been provided.

Reaching the light-house, through the courtesy of the keeper we were enabled to set up the theodolite in an advantageous position — near the top of the tower — though the clouds, hiding Bald Peak entirely from view, rendered the possibility of work dubious. The sun first parted the clouds that enshrouded the Bald Peak, and almost immediately the bright flash of the helio-stat signal showed that the assistant had already made the ascent despite the storm, his signal sparkling in bright contrast with the back-ground of dark storm-clouds. Quickly turning the telescope of the theodolite upon this signal, and the cross-hairs delicately into position, with the aid of the tangent screws the circle was clamped at zero, and we were prepared to measure the angular distance between it and the Crown Point light-house. The telescope was now turned eastward, and long and earnest search made among the tree-tops of the projecting portion of Chimney point, in the hope that at least the spire of Crown Point light-house might be visible. Though narrowly conducted, the search was fruitless; and now the flash of a helio-stat signal, far southward at the water's edge, at a point on Crown Point, westward of the light-house, showed where the two other assistants had, in accordance with orders, stationed themselves. The angle between this station and the mountain-top was now carefully measured, and repeated on different parts of the circle, so as to secure its accurate determination. At an appointed hour the work ceased, and the different parties, by boat and by team, drew together at the Port Henry headquarters.

From Bald Peak, assistant James reported that, in making the ascent of the mountain during the storm, among the ledges near the summit he lost his foot-hold, and in saving himself had broken the mirror signal. The larger fragments remaining on the ledges, he had gathered and replaced, and used in signaling when the storm was over. The storm being unexpected, he had suffered from exposure. From Crown Point it was reported that the new station selected was about 1,000 feet west of the light-house, and the first available point from which the signal at Barber light-house was visible. The angle between the Bald Peak signal and our signal (managed by my assistant) at Barber's Point had been carefully measured by theodolite No. 2, and from the light-house tower the angle between the new station and Bald Peak.

July 15th was an extremely hot day. Securing a boat and boatmen, accompanied by three assistants, I proceeded to Crown Point with the intention of measuring a short base line to determine the distance of Crown Point light-house from our new station. This was successfully accomplished, and a large stan-helio signal was permanently erected at the station, in order that it might be discerned, when desired, from the mountain peaks.

To complete this triangle another ascent of Bald Peak would be necessary, for the new station had not been in existence when we were last upon the mountain, and the angle between Barber's Point light-house and the new station (called Crown Point sub-station) remained undetermined.

I had resolved to measure another great primary triangle further to the north, as a check upon the determinations based upon Bald Peak angle, and before again ascending to that mountain summit I concluded to make a reconnaissance inland, north-westward, in Elizabeth-

town, Jay and Lewis, in Essex county, in order to find which mountain there, would be most available as the vertex of this angle.

The base for this more northern primary triangle was to be the distance between the light-house on Split Rock point and that on Juniper island, in Lake Champlain. This distance, with the astronomical coördinates of the light-houses, had been determined by the United States coast survey, affording a *base line* more than eleven miles in length, of extreme nicety and precision.

With the intention of executing this interior reconnaissance, we proceeded on the 16th to Elizabethtown, and in the afternoon the two mercurial barometers were stationed at the level of the Boquet river, and, from the observations taken, the altitude of the station has been computed at 493 feet above tide level in the Hudson.

July 17th was drearily stormy, and kept us within doors. The time was improved by instruction of the assistants in their duties, with practice drill of two assistants.

The 18th opened as stormily as the preceding day. In the afternoon the clouds began to break, when, quickly assembling the party, a rapid march was made to the foot of Mount Discovery, a few miles north of Elizabethtown. In making the ascent of the higher summit we were enabled to ascertain the height of the inferior hill (little Mount Discovery) by leveling and barometrical observations (since computed at 1,375 feet above tide). Reaching the main summit, its barometrical measurement was immediately entered upon. Angular measurements were made, and a copper bolt (No. 6) sunk in a hole drilled in the rock.

Though the storm had again gathered the clouds into dark compact masses not far overhead, and the principal mountain tops were hidden by them, the view toward Lake Champlain was unobscured and was sufficient to satisfy us that this mountain top could not be made available as the vertex of the second great primary triangle. The inferior height of the mountain would have made it undesirable, but one of the extremities of our base line being hidden from it by intervening ground, its use as a station was out of the question. A reconnaissance map was made of the vicinity, the basis being the bearings taken on the peak. The height of the summit of Mount Discovery has been computed, from the barometrical observations, at 1,582 feet above tide. About evening we descended and returned to Elizabethtown. This mountain having proved valueless for our immediate purposes, it was necessary that other peaks should be climbed until a suitable station should be found.

The morning of 19th was lowering, and we watched the barometer and the clouds for signs of clearing weather. At noon the indications were favorable, and with the theodolite in knapsack, we drove to the foot of Raven hill, and proceeded thence on foot directly to the summit. Appearances had not deceived us, and ere long the clouds drifted away from the mountain peaks, and gave me an opportunity to judge of the value of this mountain as a station. Its value as a triangulation station was evidently great, but as soon as the theodolite was placed, it was perceived to be as unavailable as Mount Discovery for the purposes of the primary triangle. Looking down upon the bright expanse of Lake Champlain, it was readily seen, that, though we had

gained a view of the Juniper Island extremity of our base line, the other end was not visible.

Continuing steadily the angular measurements, night crept upon us, and in the darkness we descended the steep mountain side, and reached Elizabethtown at 10 P. M.

From the barometrical observations of this day, I have computed the heigth of Raven hill, at 1,982 feet above tide. Our theodolite station on the peak is distinguished by copper bolt No. 7, sunk in the rock.

Sunday, July 20th, was an acceptable day of rest.

July 21st was beautifully bright, and will remain a memorable day in the annals of this survey. In doubt and gloom at the failure of two attempts to find for the vertex of this triangle a suitable mountain, which would command a view of the extremities of the Lake Champlain base, I determined to separate the party for the day, into two divisions. Sending two of the assistants again to the summits of Raven hill with one theodolite, and orders to make such better search for the hidden station as the clear atmosphere of the day permitted, I took with me three men, with barometers, transit, etc., and drove to the foot of Mount Hurricane, a prominent peak, about six miles west of Elizabethtown. On the way the altitude of Cobble hill was taken with level and barometer from a station on the slopes at the foot of Hurricane mountain. The computed results of these observations would indicate for the Cobble, a height above tide of 1,836 feet. After a lunch in the woods at the foot of the mountain, the men shouldered the heavy knapsacks containing the transit instrument in its box, etc., and we made a rapid ascent. The prospect from the summit was enchanting. In the east, midway between us and the green billows of the Vermont mountains, lay Lake Champlain, a liquid, silvery avenue of commerce, bearing here and there, slow moving specks of white, scarce recognizable as sloops and schooners; while in the south-west the haughty, high peaks of the Adirondacks were clustered in dark magnificence. Below us, plunging sheerly downward, was the defile of Pitch-off mountain, walled in upon the other side by grim mountain crags, whose wantonly burnt timber had left them scarred and hideous.

The theodolite being set up, a careful search was begun with the telescope for our lake stations. It was soon found that Juniper Island was visible, and a careful focusing at length made clear and distinct the tower of the light-house. Still the mountains southward seemed to hide the Split Rock station, and with little hope the instrument was brought to bear upon that portion of the lake, when to our delight, as the telescope slowly traversed southward, the Split Rock light-house came into view, just at the edge of hills which we feared were hiding it. *We had found the station!* No better or more appropriate one, than this mountain top, could have been selected. Taking the center of Juniper Island light-house, as zero, the work of angular measurement was entered upon and crept slowly from the left to the right. Now the sharp peaks of mountains were measured upon, and now the angular distance of the dark defiles and passes found — all from this new and advantageous station whose absolute position upon the world's surface we would soon be able to determine.

A little after midday the flash of the helio-signal was seen from Raven hill, where the other assistants were busied, and enabled me to measure the exact position of their theodolite under which the copper

bolt had been sunk. So interesting and absorbing was our work, that in silence we labored steadily on till the sun's fading glory, reddening all the west, bade us hasten our descent. Quickly the instruments were taken down and repacked, and from the rugged crest of naked rock we descend into the timber, and continuing downward without stopping, reached by dark the more level ground at the foot. The result of the day's work, and the various changes rendered possible or necessary by it, afforded me plentiful food for reflection as we drove back to Elizabethtown through the night. We had secured a complete circuit of the horizon with the theodolite, besides repeating the angles; and had sunk a copper bolt (No. 8), at the theodolite station. We had not, however, brought with us a suitable signal for the station; and topographical mapping of the mountain slopes and ridges was incomplete, and rendered another ascent of the mountain necessary.

At Elizabethtown the assistants from Raven Hill reported that the clear weather had only rendered it certain that that mountain was unavailable for primary work. From their barometrical observations, synchronous with ours upon Hurricane, I have been able directly to compare the altitude of the two mountains, and have computed the height of Hurricane above Raven Hill at 1,781 feet.

The height of Hurricane above tide would be better determined with the observations of the morrow. It is hereafter given.

July 22d proving bright and clear, the contemplated movements were put into execution. One party was sent with instruments and signal to Wood Hill, with orders to measure it and make a topographical reconnaissance with plane-table. Another series of observations at the Boquet River station in Elizabethtown, on this morning, when computed, indicated an altitude of 499 feet above tide. The mean height above tide of the Elizabethtown station may therefore be assumed to be 496 feet, or 404 feet above Lake Champlain. The whole party was occupied in the morning in measurement of a short local base line in the plain near the village, for the use of the Wood Hill party. This having been accomplished, I procured a team, and with my immediate party drove to the foot of Hurricane,

The day being warm, the ascent was toilsome,.yet we found the cold breeze sweeping the summit refreshing. The topographical reconnaissance having been completed and some of the angles repeated, the theodolite tripod was removed, and in its place the frame work for a large stanhelio-signal placed. The material for the signal was then unpacked and the twelve large sheets of tin placed in position and wired together. The work completed, at nightfall we left the summit, and making our way to the foot of the mountain, drove back by starlight.

From the hypsometrical work the height of Mount Hurricane has been computed at 3,763 feet above tide, and the synchronous observations of the 22d indicated that it exceeded Wood Hill in height by 2,611 feet:

Elizabethtown station (Boquet R. level).............	$496\frac{13}{100}$	feet.
Height of Wood Hill station above tide.............	$1,151\frac{60}{100}$	"
Wood Hill station above Elizabethtown station.......	$665\frac{47}{100}$	"
Mount Hurricane above tide.........................	$3,763\frac{32}{100}$	"

Mount Hurricane above	Raven Hill	1,781$\frac{10}{100}$	feet.
" "	Wood Hill	2,611$^{\underline{11}}$	"
" "	Elizabethtown station	3,267$^{\underline{12}}$	"
" "	Lake Champlain	3,671-32	"

July 23d was as clear and brilliant as the previous day. While one assistant remained at Elizabethtown to complete the plane-table work, I took with me the remainder of the party to make the ascent and measurement of Cobble Hill, a precipitous little mountain southward. It is an excellent station for topographical work, the whole Elizabethtown valley, north and south, being visible; and I secured two valuable though small reconnaissance maps from its summit. While engaged in making angular measurements I was pleased to see and to be able to use the automatic stanhelio-signals, both upon Mount Hurricane and the Bald Peak in Moriah. They afforded sharp, brilliant points for measurement, and during this sunshiny day were constantly visible. As we gazed upon them steadily gleaming and sparkling, miles away, it seemed impossible that they could be mere machines, unpossessed of life or thought.

We descended early from the peak, well satisfied with the results of the day, the working of the signals and the local maps secured. From the barometrical observations taken from the summit of Cobble Hill its height has been computed at 1,936 feet above tide level. This measurement when compared with that by level, etc., from foot of Hurricane — a single observation — indicated a difference of 12$\frac{86}{100}$ feet.

Cobble Hill above	tide level	1,936$\frac{37}{100}$	feet.
" "	Lake Champlain	1,844$^{\underline{37}}$	"
" "	Elizabethtown station	1,440$^{\underline{24}}$	"

The time which I had allotted for work in this neighborhood having passed, and having found in Hurricane the mountain proper for the vertex of the great northern primary triangle, it was advisable that, while the clear weather lasted, we should proceed to the termini of the base, on Lake Champlain, and complete that triangle by careful measurement from the light-house stations to the automatic signals on the Hurricane.

On the 24th, having repacked and transported all our baggage and instruments from Elizabethtown to Westport, we reached Burlington, Vt., by steamer. This port, being but a few miles from Juniper Island, was the most available headquarters for work at that station.

July 25th was hot, and extremely hazy, and even the further shore of the lake was invisible. In the afternoon we proceeded to the light-houses on the Burlington breakwater, and made angular measurements between the stations and the Juniper Island light. A violent gale had roused the whole lake into sweeping foam crested billows, and we had great difficulty in climbing on and descending from the breakwater with our instruments.

July 26th was bright and promising, though the distant Adirondack peaks beyond the lake were still obscured by haze. Chartering a yacht, we set sail for Juniper Island, but the wind settling down to a calm, we were compelled to work our passage and assist the sailor at the

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oars. Effecting a landing on the island, our instruments were conveyed to the light-house, and the theodolite placed upon the turret. A storm, however, had gathered, and the rain compelled us to beat a retreat.

During the storm we partook of dinner with the light-house keepers, and as the sky brightened, reascended to the turret and replacing the instruments entered upon our work. The summit of Hurricane was easily distinguished, but so distant was the Split Rock light-house, that we could barely detect its position, and we concluded that it would be necessary to employ mirror signals in the determination of the angles. Meanwhile, numerous measurements were made with Colchester Reef light-house and the light-house on south end of Burlington breakwater alternately, as zero to Hurricane mountain, the summit of Poke-a-moonshine mountain and to the other Adirondack summits visible. Making arrangements for further work, at the approach of evening we took advantage of a favorable breeze and set sail for Burlington. The breeze brought up a sudden heavy rain storm of which (being unprepared) we had the benefit.

July 27th was Sunday. On the 28th I detached two assistants for the Juniper Island work, whither they were to proceed with one theodolite, helio-stat, etc., on the following day. Providing them with funds for their work, and leaving under their charge at Burlington the heavy baggage, we took the steamer the same day, and proceeded down the lake to Essex, a port on the opposite side nearest to Split Rock. Immediately taking a team we hastened to Split Rock, and proceeding to the tower of the light-house, set up the theodolite. In the west, though far inland, Mt. Hurricane arose sharply against the sky, and even while I adjusted the instrument, the helio signal of my assistant was answered by the flash from the signal man on Juniper Island, which was itself almost invisible at the edge of the northward water horizon. Our success was perfect. Simultaneously the two angles were measured at the two stations; again and again at each station the telescope traversed from the starlike helio-signal to the summit of Mount Hurricane,—a satisfactory specimen of well disciplined and successful work. At nightfall I sent up rockets as signal that the party on Juniper Island should join me on the following day, and returning to our team, we drove again to Essex.

The following morning, July 29th, the party detached, rejoined us with our baggage by steamer, and with them we proceeded down the lake to Port Henry, determined to see whether we could not put as satisfactory a period to the work there, as we had done to that upon the northern base. It will be remembered that the difficulty at this station was the interference of a wooded point which projected from the Vermont shore, and hid one light-house from the other. Having no other data, at present, from the Coast Survey we were without a zero for measurement. It was desirable to avoid any complication of angles, for in platting them even by their chords on the scale of one-half an inch to the mile there would be opportunity for error.

It seemed possible that the cutting of a few trees on the point would open the vista and enable us to finish this part of the work.

To determine this question, we proceeded the same afternoon by boat across Lake Champlain to the point, and selecting a station as nearly upon the line between the light-house as possible at the north side of

the woods, sighted upon Barber's Point light-house, and reversing the telescope, ran a transit line southward.

Considerable difficulty was experienced, but emerging from the woods we were pleased to find the line of sight direct upon the Crown Point light-house.

This line could not be employed in our measurements, but it showed us, by the forest through which we had passed, that the cutting of a sight line would prove expensive. It was already evening, and exhausted by a long and tedious march through forests and meadows, dripping with the rain, we sailed back to Port Henry.

July 30th, I determined to again ascend Bald Peak, and measure the angle between our sub-base station on Crown Point, and the light-house. Desiring also to eliminate instrumental error in the measurement of this corner of the triangle, we took with us two theodolites intending to repeat the angles on both the horizontal lines. We drove by way of Moriah and Mineville directly to the west foot of the mountain — the side most easy of ascent -- and carrying the theodolite climbed to the summit. Here we were surprised to find that some malicious persons had nearly destroyed the fine large stan-helio signal. Some of the tin was gone, the remainder scratched, defaced and riddled with rifle balls. Removing it, the theodolite work proceeded, and the careful remeasurement of the angles, first with one and then with the other of the instruments, was very satisfactory. The stan-helio signal at the sub-station on Crown Point was intact, and was brilliantly visible. We completed the field work, replacing the signals, in time to drive to Port Henry again the same evening. The injury to our signal proved that in order to keep it intact upon Bald Peak for use as a zero, when we were engaged upon the work back in the wilderness, I should have to place men there to watch it. The period allotted for the Lake Champlain work had now elapsed, and it was necessary for us to return to Albany to refit with camp equipage for the wilderness. Accordingly on the 31st we left Port Henry on our return.

The condition of the Bald Peak angle was not satisfactory to me, but I concluded to wait until autumn or winter, and meanwhile to endeavor to secure from the United States Coast Survey information of such other of their stations in that neighborhood as would afford me a zero, and proper latitude or space for the work which I desired to do.

FIELD WORK.

SECOND DIVISION.

First Expedition into the Wilderness of this Season.

The equipment of the second expedition, with repairs of instruments, etc., was only completed by active labor in the first week of August. Of the four mirrors signals (portable) which we had taken into the field in July, but one remained, the others having been shattered to fragments by accidents in the climbing of mountains, headlong falls on the rocks of those carrying them, or — as in one instance in a haversack — by the pressure of books against the glass. New mirrors of thin glass, purchased at Port Henry, had soon gone the way of the rest; and as these heliostats were very useful at all stations where the labor and expense of erecting a large stan-helio signal was

undesirable, something more substantial had to be provided. The three empty frames were re-filled with heavy French plate-glass, one-fourth of an inch in thickness, forming mirrors, having each a reflecting surface of eighty superficial inches. Practically, and by the laws of reflection, such mirrors were infinitely superior to the irregularly-surfaced glasses first employed, and as not one of them was broken during the subsequent work, they were, in the end, much cheaper, as certainly more reliable. Three of the four barometers required adjustment, and were taken to New York, repaired, and made to read exactly with the standard barometer of James Green (instrument maker to the Smithsonian Institution and the U. S. Signal Service), by whom all the repairs of our meteorological instruments were made. The theodolites were again taken to Troy, N. Y., where they were thoroughly examined, and such adjustment as required made, by the Messrs. W. & L. E. Gurley, the well-known manufacturers of transits, solar compasses and other surveying instruments. The rubber water-proofing of the portable canvas-boat having dried, the boat was taken from its temporary frame, rolled up and packed away in trunk. As heretofore stated, no frame is carried with the boat, and, forming a light package less than one-half a cubic foot in size, and weighing only ten pounds and eight ounces, it formed one of the most important parts of our equipment, being, in our opinion, as a light portable boat, superior to any thing ever previously made or used. A hundred minor matters, such as the making of a lantern entirely of brass for use around the magnetic needle at night in the determination of the magnetic declination or *variation* by astronomical observations; planning and superintendence of the manufacture of large leathern water-proof haversacks, with locks, to contain and carry our maps and field-books, etc., etc., took much time. The partial destruction of our stan-helio signal on Bald Peak, and the probability of its being stolen or entirely destroyed unless watched, brought me to the decision that some one should be left at that station to protect it. To this duty assistant Prescott was assigned. A house on the plateau west of Bald Peak, four or five hundred feet below the summit, would afford a convenient stopping-place from which the station could be reached at any time. He was accordingly furnished with funds sufficient for himself and companion, Mr. Goeway, with the mirror signals, etc., and directed to proceed on the 15th of August to station, to remain ten days; executing meanwhile repetitions of my previous angular measurement (with theodolite No. 2), in order to secure an accurate mean from the series.

The preparation being complete, on August 11, with three companions, I left Albany, and by way of Lake Champlain, reached Westport, whence we drove, with our baggage, to Elizabethtown, and, after supper, by special team, hurried to Keene Flats, Essex county, which we reached late at night. This mountain-locked valley was the center of our immediate labors, the bald summits in its neighborhood affording excellent topographical stations, while the altitude of the famous valley itself, and of numbers of the neighboring mountains, were unknown.

August 12. While two assistants were engaged in barometrical leveling stations at the upper and lower ends of the Keene Flats valley, I collected and engaged the best professional guides and packmen — some of my old men — for our mountain work, and had the provisions

prepared, back loads of bread, etc., baked for the field rations. In addition, my attention was given to the barometrical work at each station, and a reconnaissance map of topography made. From the barometrical observations, I have computed the altitude of the lower station at Keene Flats (Phelps'), at 1049 feet above tide; the synchronous observations at the upper station (Beede's), indicate for its altitude 1,240 feet; the height of the upper station above the lower, by a direct comparison of synchronous readings is, however, only $191\frac{24}{100}$ feet.

August 13. Leaving to others the gathering of supplies for the commissariat; the day opening clear, I drew together the survey party, with two of our guides and two volunteers, and drove from our head-quarters to the foot of Hopkins' Peak, which, together with the famous mountain, Giant-of-the-Valley, I proposed that day to climb and measure. At the settlement, midway in the valley (Dibble's), one assistant was dispatched with barometer for observations at lower station synchronous with ours upon the peak. The day proving very warm, we reached the summit of Hopkins' Peak at half past 12 P. M. Gazing out upon a wealth of mountains and valleys spread before us, we regretted that there was not more time. However, seizing our opportunity, the theodolite box was taken from the knapsack of the guide carrying it, and adjusted upon its tripod on the summit of the peak The dark evergreen forest crowding itself for standing room upon the precipitous sides of the well-named Giant Mountain behind us — the view of silent crowded crags, across the deep valley of Keene Flats — the peaceful snowy clouds and azure sky above, afforded contrasts which made the view from this point extremely beautiful. As a point determined by triangulation, it was valuable, as it gave us a commanding view of the whole Keene Flats valley, and enabled us to direct the instruments upon every point of interest within it. The labor was so important that I did not join the party who, under shelter of a ledge, beside a glowing fire, seemed to enjoy their dinner all unaware of the picturesque addition which they made to the scene. At 3:30 P. M., I concluded my measurements. The station is distinguished by a copper bolt in the rock (No. 9.) Four full pages in the theodolite book represented the measurements, and in addition three valuable reconnaissance maps were made. The height of Hopkins' Peak above the sea, by our measurement, which is believed to be the first ever made, is 3,136 feet. From the observations taken during the whole day at the lower station in the deep valley, the height of that (lower) station is computed at 963 feet above tide, and on comparison and calculation, from observations taken at the same instant of time at that lower station (Dibble's), and on the summit of the peak the height of the mountain above the lower station is computed at 2,168 feet.

Immediately assembling the party the instruments were packed and we descended from this summit on our way to the Giant, which we thought, despite the lateness of the hour, might yet be ascended and measured by a rapid march. This second mountain ascent of the day took more time than we had anticipated; windfalls of timber, dense thickets, descents and ascents along a broken ridge, rendered progress slow, especially that of the guide carrying the theodolite, packed in its box, upon his back. It was quarter to 7 P. M. when we reached the summit of the Giant-of-the-Valley. Before us was spread a vast and grand but gloomy depth of scenery. At our feet,

cliffs a thousand feet in height fell away to a gray map-like picture, as chill and silent as a world deserted and left vacant. The sun had left some crimson streaks upon the western clouds — only sufficient to make more mournful the sombreness of the rest — : the multitude of peaks seemed a myriad of gray domes and ridges, sunk together in one common slumber, to last forever.

No chirp of insect, no cry of bird or beast, broke in upon the awful silence of the scene, and as we beheld mountain on mountain stretching into infinitude, the knowledge, that through and over them, beyond the reach of sight, our labors led, and would lead us, chilled all hearts and made us silent also.

By the time that we had completed the barometrical observations — which indicate for the Giant a height of 4,530 feet — *little more than* 800 *feet below the height of Mt. Marcy* — the sun had set. A division of opinion as to the proper course to pursue now arose; for the guides asserted that it was now too late to descend. We had not a particle of water, the work had been exhaustive and our thirst was becoming unendurable. This decided the question, and we resolved to descend till we found water. * * * Off the trail — in darkness — descending cliffs — across holes and chasms — on dead fallen timber — feeling, not seeing, we made our way down to water, a narrow swift rill shooting down over the rocks and precipices. Refreshed and invigorated by water — cold and pure — the only drink which the Creator, in his wisdom, has provided for man and beast — we resolved to continue the descent; and hideous hours passed away as we crept down amid dangers which we often suddenly felt when it was almost too late to recoil. Our pocket lanterns — when the ground became such that one hand was at liberty — were of great assistance. It was one o'clock in the morning when the moon came to our aid, and we emerged from the forest, having successfully effected our descent. Marching quickly to quarters by moonlight, we satisfied our hunger by a breakfast-supper and retired for a short rest to fit us for the labors of the next day.

Daylight on the 14th showed lowering clouds that threatened storm. One of the guides, alarmed at the experiences of the previous night, withdrew, and another whom we had expected this morning did not come. As the heavy packs, deserted, could not be moved I gave the third guide leave of absence for the day, the weather settling to a heavy storm. The guide reported again at evening. He had been unable to secure any additional men.

August 15. The storm still continued and it grew cold. Proceeding to institute comparative readings of the barometers, I was shocked to find that the mountain barometer, which we had used in the measurement of the Giant, was broken and utterly useless. Only a part of the quicksilver remained, and some of this entering the crevices of the brass portion of the instrument had amalgamated with that metal and defaced and injured it. We could ill afford to part with this instrument for a day, but its immediate repair was the only resource, and it became necessary for one of the assistants to return with it to New York. Two additional guides were secured to-day, and every thing being completed, orders were issued at evening for march into the wilderness the next morning.

The plan of work for the week ensuing was as follows: One assistant having in charge the broken barometer would return to New York

via Albany; secure the repair of the instrument, and bringing the extra tubes and iron bottle of quicksilver, with other matters, would rejoin us at Keene Flats precisely on the sixth day. The survey party in the meanwhile would march into and explore and map the unknown region south of Keene near the Hunter's Pass; thence ascend Mt. Dix, then effect the passage of that defile which lies north of Mud or — as it is now called — Elk lake; thence climb Nipple Top mountain and descend into the Elk Pass, the defile next westward, whence we would in turn ascend the next mountain, which forms the eastern mountain-wall above the Ausable lakes, thence returning exactly on the sixth day to our Keene Station.

On the morning of the 16th this plan was put into operation; the assistant set out early by team to Westport, with three guides carrying, besides their axes, six days' rations of bread and meat in packs, and the theodolite; leaving behind us trails and marked trees, we struck into the forest. Climbing into the Round mountain notch, the summit of which our measurement shows to be 2,546 feet above tide, we left the rills which run to the Ausable and descended to the head waters of the Boquet river. From a cliff which made an opening in the timber, we obtained a glimpse of Mt. Dix, bearing south 21° 45′ west; making note of this bearing, we left the cliff, and, again enshrouded in the dense woods, made our way southward through this upland valley. At noon we halted for rest and dinner, and three hours afterward reached the Boquet river, here a considerable stream. From the barometrical observations the height of our bench mark at this point on the river, is found to be 2,425 feet above tide. The mountains towering on all sides and shutting it darkly in, made it seem little like an upland valley, more than three hundred feet higher than the summit of Bald Peak. Following the river through this pathless forest, which was, however, everywhere tracked by the foot-prints of wild beasts; now fording the stream to escape precipitous climbing, now clambering up over the huge rocks in its bed, over and amid which the clear water fell foaming; we pushed forward, noting at one time the entrance of a stream from the right, and at another the inrush of some miniature cataract on the left, till the steepness of the climbing and the slenderness of the stream, showed that we were approaching the sources of the Boquet river in the Hunter's Pass, which is also called the Dial Gorge. At 5:30 P. M., we unslung knapsacks and joined in constructing a camp. Ground was cleared of underwood, etc., on a small level space near the fork of a stream that shot down through a rocky flume, leap on leap a hundred feet into the river. Huge sheets of bark were peeled from the spruce trees and laid upon the frame-work of our shanty; wood for the camp fire was cut in logs and heaped, and after supper we fell easily asleep, the great fire crackling and flaming before our hut.

The morning of August 17th opened brilliantly. The golden sunshine glimmered around the mountain crests; and anxious to avail myself of so favorable a day, after breakfast the heavy baggage was left in charge of one who remained at the camp, and we immediately commenced to climb the slopes of Mount Dix, which was to be the next trigonometrical station. This was an entirely different route from that by which I ascended this mountain in 1870 where we marked a line and cut a path through the timber. Here there was no sign,

but instead, paths stamped by the footprints of deer, panther and bear showed us where these creatures had found spots amid the cliffs which they could climb, and availing ourselves of these runways, we slowly toiled upward. By 9:30 A. M. we had reached a height as great as that of Camel's Hump Mountain, and carefully finding its level, we took its height by barometer, which when computed and corrected for curvature and refraction, gives for its altitude above tide 3,548 feet. It was after 11 A. M. when we reached the level of Nipple Top, and looking across the depths of the Hunter's Pass, we could search the opposite rugged mountain for some path by which to climb it. The exact level of Nipple Top was carefully determined, and the station being favorable, a base was measured with steel tape along the mountain side, and the angular distance of that mountain from this station found by measurement with sextant from each end of the base. This would admit of an exact application of my method of leveling with barometer and hand-level, and a careful computation, based upon this work, showed Nipple Top to have a height of 4,656 feet above the sea. After struggling through dense thickets of spruce and balsam, at half-past one in the afternoon we reached the summit of Mount Dix. It was wonderfully clear, not a cloud to be seen, and the atmosphere comfortably warm. No signal was at first visible upon Bald Peak, which from this height appeared as a rocky mound, yet the unaided eye could distinguish near the shore of Lake Champlain the glimmer of the automatic stanhelio-signal upon Crown Point. Setting one man to helio-signal Bald Peak, in order, if possible, to obtain a response from the assistants stationed there, we set up theodolite and barometer, and entered on our work. Northward Mount Hurricane was seen, and the theodolite telescope was hardly directed upon it before the flash of the automatic signal I had placed there was visible, and proved the wonderful success of the invention. The angular measurements were rapidly progressed, and with the aid of the telescope the Bald Peak stanhelio automatic signal was seen, and its angular place found with precision. At a quarter to four in the afternoon our signal was answered by a flash from Bald Peak; the first intimation that we had of the presence of the assistants at their station. It was needless, for the stanhelio signal had served all our purposes. As the afternoon shadows lengthened we pushed our work without rest or conversation, and Crown Point light-house being visible, formed a third zero and established point, with which the other measurements were joined. Clear Pond, Mud or Elk lake, the Boreas range, Haystack, Marcy, and a multitude of other points, were reached, twelve pages in the large theodolite book being occupied with the records of measurement. Four reconnaissance maps of topography were made, and forty-six barometrical observations upon the summit gave a mean that enabled us to determine the height of the mountain with greater accuracy than ever before attainable; my computation showing Mount Dix to be 4,916 feet above tide level. The height of this mountain, according to Prof. Emmons in 1837, was 5,200 feet. It is unfortunate that without climbing or measuring it by barometer, he should have been led to record such an erroneous approximation.

Absorbed in our work we were startled by sunset to the consciousness that night had already settled in the chasm valleys below. It would be impossible to descend in the dark, amid the cliffs and ledges,

where only the footprints of the catamount had guided us by daylight to places which could be scaled; and our camp and camp-guard and provisions were miles away. There was no time for discussion and I ordered a descent into the Hunter's Pass, so far down as it would be necessary to find water and a resting place. Water, unfortunately, was not to be readily found, and soon we became entangled amid ledges, slides and cavernous rocks that rendered the previous night-descent of the Giant inferior in danger. In the darkness, clinging by roots, aiding each other from ledge to ledge, and guiding, with special care, the footsteps of those carrying the theodolite, etc., we finally found ourselves slipping on the edge of rocks draped in cold, wet, sphagnous moss, and a little lower we found water! A moment's rest and we descended further only to find that we were in a cul-de-sac — with walls of air — turn which way we would, save toward the mountain top; and we reached the verge of an overhanging cliff, so high that even the tree-tops below were not distinguishable. The slender stream leapt the edge and was lost in the depths. Here we were compelled to halt, and reclining at the edge of the precipice, passed the night; the feeble fire, by its suggestions of supper — which we had no means of gratifying — only giving edge to our hunger.

Daylight, August 18th, showed us the wildness of our situation, and the means of extrication; and, breakfastless, after dangers unnecessary to relate, we descended to the south portal of the Hunter's Pass upon a stream which flowing southward, out of the pass, formed one of the sources of the Hudson river. Turning northward we entered the portals of the Hunter's Pass (the Gorge of the Dial), which so many have longed to explore and endeavored in vain to reach, and ascended betwixt its walls of rock to its summit. Here barometrical observations were taken. They indicate the height of the pass above tide to be 3,247 feet. The inclosing mountains rise over a thousand feet above, on either side, and the spectacle is grand and imposing. Descending northward we were once more on the St. Lawrence river side of the mountain range. We had left camp for the ascent of Mount Dix, with the intention of returning that night, and now, fearing lest our friend left there should become alarmed at this continued absence, we marched as rapidly toward where we thought the camp might be as our exhaustion permitted, firing occasionally revolver shot signals to acquaint him with our approach, but more, perhaps, with the hope that he might prepare us a breakfast. We at length found camp and man all right. A heavy storm in the afternoon tried the value of our bark roof, and gave us opportunity for rest. Barometrical observations this day give the height of this station at 2,788 feet above tide.

August 19th. Raining slightly and very threatening. Determined, nevertheless, to set out upon the ascent of Nipple Top mountain, on the eastern slopes of which we were encamped; followed up a stream till its course diverged from what (so far as we could judge in the fog and storm surrounding us), would be our way; climbed steadily, and at 1 P. M. thought we were upon the summit, but having chopped down trees, and the clouds rolling away, we saw another summit further south which we reached at 2 P. M., which proved to be the true crest. Dense white cloud enveloped us, but it was in rapid motion, and at intervals opened and showed glimpses of chasms and mountains. Sud-

denly it was swept away at the east and Mount Dix, scarred and savage rock, rose before us; beyond it the rolling country near Lake Champlain, with our Bald Peak, like a little hillock, beside the distant gleaming lake. The gorgeous sunshine streaming on the distant cirro-cumulus clouds below, produced a rare effect. Suddenly, starting with surprise, our mingled shouts arose, for on the breast of the cloud each saw his own form, the head surrounded by a rich *anthelia*, a circular glory of prismatic colors, the renowned "Ulloa's rings," which that philosopher beheld from the summit of the Pambamarca. Not one of the mountain guides had ever seen or heard of such sight before. It was gone all too quickly, yet it seemed as though nature to-day were reveling in splendors, for the clouds vanishing in the west, a sierra of mountain crags was uncurtained, torn rugged and wild, above all which rose Ta-ha-wus, "Cleaver of the clouds." Topographical maps were executed and in our barometrical work we had the first record of measurement made on this summit. From these *direct* observations the height of Nipple Top has been computed at 4,684 feet above tide level. It will be remembered that the height of this mountain had been taken two days before by combined barometer and spirit level from Mount Dix, and computed at 4,656 feet. The difference is twenty-seven feet, far within the limit given by Humboldt for mountain measurement.

Not designing another night climb (as we carried now all our camp equipage), we left the summit at 5:30 P. M., and descending rapidly, reached the bottom of Elk Pass in time to erect a shanty of boughs.

The camp was in an open grove fronting an unknown waterfall, which from its silvery spray and step-like form I named the *Fairy Ladder Falls*, the height of the foot of which I found to be 3,111 feet above tide.

Rousing the men early on the 20th the last ration of flour baked, and breakfast over, leaving at this camp all our impediments, we commenced our climb to the summit of the next mountain eastward, which the guides had named Mount Colvin. The knowledge that it was a mountain heretofore unascended, unmeasured and — prominent as it was — unknown to any map, made the ascent the more interesting. The indications of game were naturally abundant; the rocks and ledges ·ologically interesting, and, judging by the outlook from inferior sum-
.its, the view from the top could not fail to be superior. A trap or *sienite* dyke was discovered, but there was no time for its examination, and reaching at length the height, its last approach a cliff almost impregnable, we drew ourselves up over the verge to find a seat upon a throne that seemed the central seat of the mountain amphitheatre. Deep in the chasm at our feet was the lower Ausable lake, each indentation of its shore sharply marked as on a map; beyond it the Gothic mountains rose, carved with wild and fantastic forms on the white rock, swept clear by avalanches and decked with scanty patches of stunted evergreens. Everywhere below were lakes and mountains so different from all maps, yet so immovably true. There was too little time to satisfy us. Here was golden sunshine, a balmy air and a wealth of work before us, but an empty larder. It was the sixth day, the evening of which I had before set as the termination of this branch expedition. Topographical reconnaisance was therefore pushed forward, and a careful measurement made, from which the height of Mount Colvin is found to be 4,142 feet above tide level.

It was after 4 P. M. when we left the summit and hurried down into the Elk Pass again, and reaching a point further south than our camp, on the Hudson river waters, we came upon a beautiful meadow, and further, on a shallow pond which we called "Lycopodium," from the occurrence of that plant near its shores. The height of the summit of Elk Pass was found to be 3,302 feet. The sun sinking fast, we hastened on, reached our camp, slung on the knapsacks we had left there, and on a run struck northward down the rugged unknown pass; yet hardly hoping to accomplish that night the miles of wilderness between us and the first settlement of Keene. Still, we strained every nerve, pressing onward without resting, seldom glancing at the compass, guided better by the sun upon the peaks, of which now and then some opening in the thick foilage of the trees would give us view.

Twilight, and still marching, despite the wish of wearied men to camp. Dark, and still marching. Night, marching; and our goal gained. We were partaking of a late supper at Keene Flats, when the team drove to the door with the assistant returning from New York, barometer, etc., repaired, and every duty well discharged. In all things we had met with uninterrupted success, and every mountain and pass which we intended to visit had been reached and measured, and the work accomplished exactly within the six days set. In accordance with directions, a quantity of bread had been prepared during our absence, sufficient for our present needs, and every thing was in readiness for the further prosecution of the survey.

The work which was now to come would be in the very heart of the mountains, and though I determined to make Keene Flats our base of supplies till we had crossed the main range, it was evident to me that the party would not again visit this valley. I therefore directed all the extra and reserve baggage to be packed (cutting down on every thing not absolutely needed), and ordered its transportation by team to North Elba, which I judged would be the next point we should strike after perhaps a month of labor amid the higher mountains. The duties immediately before us were peculiar. It was absolutely necessary that we should have clear weather upon three or four of the prominent peaks in order that we might connect our base of Lake Champlain this season with the work of last year. Besides the summits which we had measured during the previous years of the survey, there were many mountain monarchs, as yet unmeasured and unascended, valuable as affording stations for crossing angular lines in measurement on points in the lakes or valleys below, of which the guides and the amateur explorers who had seen them, held different opinions as to their actual and comparative height, the depths and availability for use of the passes between them, and the possibility of lakes, of river sources hitherto unknown, and hidden wonders amid their recesses. To confirm and connect our previous work, to clear away doubts and to determine these unknown points, were the main duties. The right of Mount Marcy to chieftainship was even disputed by some, who thought Mount MacIntyre the highest, and I decided to settle this vexed question by comparative measurements made at the same instant of time on both mountains.

August 21. As we arrived late the previous evening, a little preparation was necessary before again taking the field; and seeing that the morning would be required, I sent an assistant with barometer to

Chapel Pond, the altitude of which I had not been able to take at the time I first visited it, some years before. Synchronous observations were taken on barometer at our upper station — head of Keene Flats valley. This measurement shows Chapel Pond surface to be 314 feet above our Keene Flats station; the height of the pond (corrected by mean height of lower station) is 1,551 feet above tide level. After dinner, the packs, provisions, theodolite, etc., were placed in a rude wagon, in charge of a teamster, and leaving one guide to bring up additional provision on the morrow, we set out for the Ausable lake. The miry, rugged, and almost impassable way, made progress slow. Half a mile from water, we shouldered our baggage, and found it so heavy that it was gladly deposited in the boat. Gliding on the long lake past the frowning cliff of Indian Face, we looked up cloudward at the sharp summit of Mount Colvin where we had stood the previous evening, over 4,100 feet in the air. It was twilight when we landed at the head of the lower Ausable lake, and night when we made our camp on the shores of the upper lake.

August 22. Sending one assistant, with guide to Mud or Elk lake, and leaving another at the Ausable shore — the object being to determine the elevation and difference of level of these waters — with two others I proceeded southward to examine the sources of the Boreas river. Crossing a low divide, we entered a swampy region whose waters were affluent of the Hudson, and reached the Boreas ponds or lakes. Much topographical work was executed, four sheets of reconnaissance being made; but the leveling done with the aneroid has proved unsatisfactory, though the height of these lakes cannot differ much from that of the upper Ausable. The sultry day was followed by a thunder storm.

The direct measurement of the two lakes indicate: *Upper Ausable lake, above tide,* 2,064 *feet; Elk lake, of Schroon waters, above tide,* 2,052 *feet;* but a comparison of observations synchronous at the two stations, shows the Ausable to be the highest by $11\frac{86}{100}$ feet.

The remaining provision had meanwhile been brought up from Keene Flats by the guide left there, and had been carried by him to the foot of Mount Marcy in accordance with my orders.

August 23. We broke camp and marched from the Ausable lake to the Panther Gorge, the east side of Marcy, where the provision had been carried. A measurement of Bartlett mountain is computed at 3,715 feet above tide.

August 24. We hastened to the ascent of Mount Marcy, in order, as the day was clear, to obtain the connecting minor signal of the party on Bald Peak. An assistant was stationed at camp, in Panther Gorge, and took, during the whole day, barometrical observations at intervals of five minutes. This enabled us to make a series of accurate measurements by level and barometer, of the peaks surrounding Mount Marcy, as, in ascending, we reached their level. Such a steady series of observations at a near lower station showing the exact change from the mean of the atmospheric pressure at any time when we took observations at a mountain level.*

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* The mean height of the Panther Gorge bench mark, as determined during the week ensuing, by five hundred and ninety-one hypsometrical observations at the station, is 3,378.71-100 feet above tide.

With this organization of the party, we ascended the mountain, (on the 24th) and the open rock slope of Marcy being very favorable to such work, we were able, in a few hours, to ascertain the approximate height of eight mountains, a labor which, by any other method, would have required weeks of marching and labor for its accomplishment. This rapid approximate measurement affords the following computed heights, which it will be interesting to compare with the other measurements elsewhere recorded:*

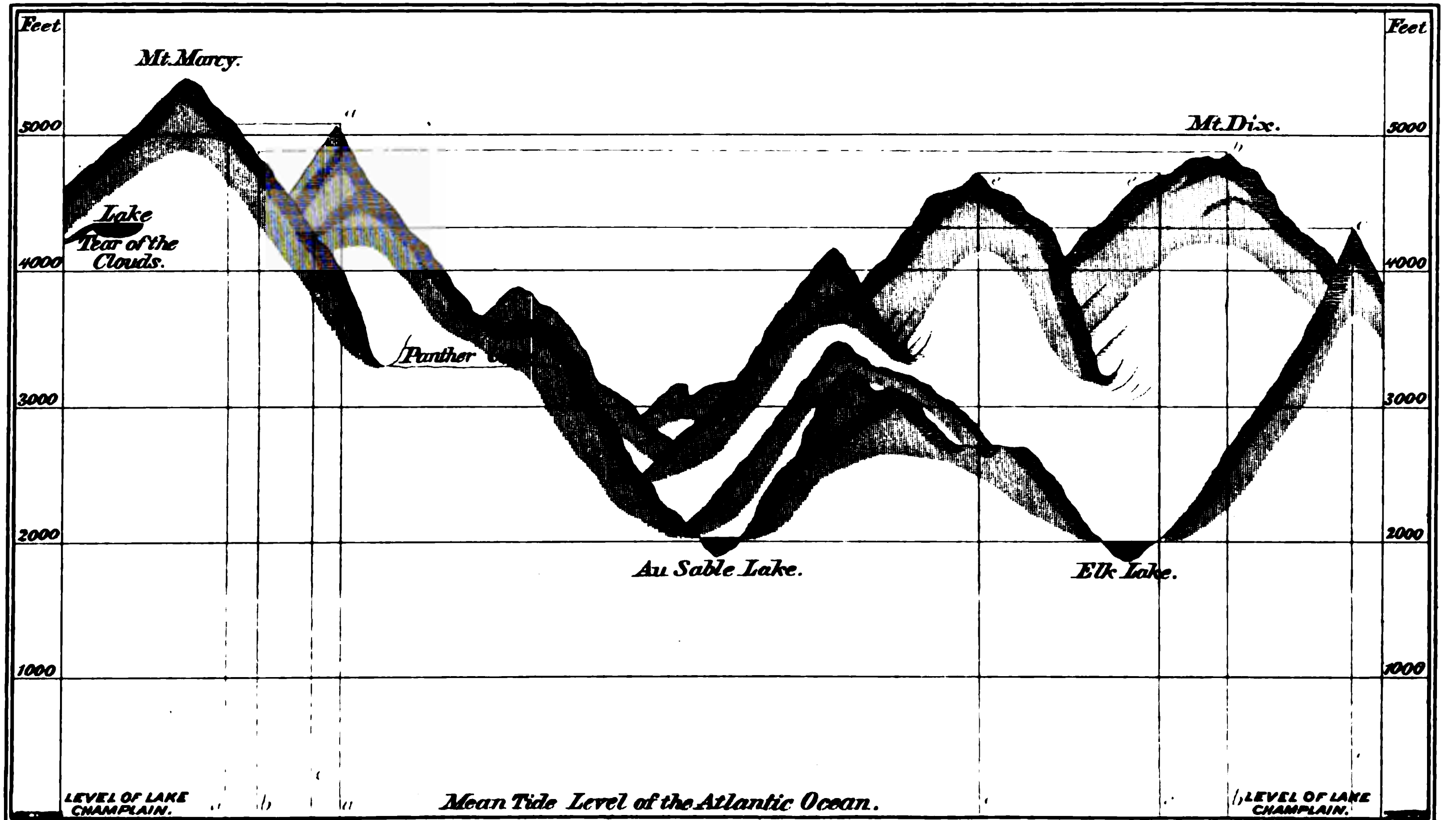
Mountains leveled upon.	Apparent height.
Macomb's Mountain	4,407.09 feet.
Grey Mountain or Peak	4,935.09 "
Mount Dix	4,959.71 "
Mount Skylight	4,997.08 "
Mount Haystack	5,006.08 "
Mount McIntyre	5,106.18 "

Of all these mountain chieftains only one, MacIntyre, had before this survey been actually measured, and I had now the singular gratification of being the first to ascertain the height above the level of the sea, of these everlasting and majestic domes of the State. Of all the mountains to which others had attributed a height of 5,000 feet and upward, on careful examination, only two — McIntyre and Marcy —are found actually to possess that height. Mount Seward, McMartin, Santanoni and Dix, reported to the legislature, nearly forty years ago, as 5,000 feet or more in height, are found to be all below that elevation; and in their stead MOUNT HAYSTACK and MOUNT SKYLIGHT — characteristic names given by the hunters and trappers form their appearance — now for the first time measured, prove to be respectively the third and fourth mountain heights in New York. While the mountains whose names are famous were ever at the tongue of those who have attempted, without explorations, to describe this region, neither knowing nor comprehending its most trifling features, these loftier peaks rose into sunshine above clouds that overshadowed their famous but inferior neighbors. It is even possible that the latter mountain may possess a height of 5,000 feet. *As it is, Mount Skylight, by this rapid leveling, is only 2 feet below the line of 5,000 feet, and Mount Haystack is found to exceed the royal altitude, affording the State another mountain of 5,000 feet.* Thus, we reached, perhaps, the most startling result of the survey, in the heretofore unmeasured mountains, Skylight and Haystack. While the determination of the height of lakes and the depth of mountain passes, will be of interest and value to those who traverse these waters or contemplate the building of railroads, of lake reservoirs, or slack-water canals for lumbering purposes; the discovery of such unmeasured mountain heights in New York, cannot fail to be interesting as well as startling to physical geographers and to those citizens who are acquainted with the written accounts of this region hitherto published.

But I defer a longer consideration of this subject till my conclusion.

While we have been engaged in making the measurement just discussed, a signal man had been busy with a heliostat in flashing signals

*These altitudes have been corrected by +106.80 feet, for height of Dudley Observatory and for local atmospheric pressure combined.



Drawn by Verplank Colvin.

Lith of Weed, Parsons & Co. Albany, N.Y.

Altitudes by Barometer & Telescopic Level.

Sectional View of a few of the Adirondack Peaks showing the Rationale of this Method of Measurement.

VERTICAL SCALE A MULTIPLE OF THE HORIZONTAL.

upon Bald Peak—here seen as a low prominence in the east—in order to draw an answer from the assistants stationed there. No response was received, yet we continued signaling till late in the afternoon. Although it was extremely clear and bright, a furious gale from the west swept the summit of the mountain and it was impossible to use the theodolite. The heavy tripod, indeed, was blown from the summit down the ledge where we were sheltered. At 5 P.M., we commenced our descent down the rock slope, two miles, into the deep gorge where we had made our camp. At night, a brilliant fire before the bark shanty, and a table of bark covered with substantial food, though under no roof but the dark starry sky, and illumined only by feeble flaring candles, made our camp pleasant to us, the more so as compared with our discomfort at the same place the previous year.

August 25. Our provisions were found to be already failing, and upon examination of the stock, I decided to send a guide to Keene for an additional supply; with orders to return the next day. The day being bright we again ascended Mt. Marcy, carrying with labor all the instruments, determined to secure the connection of our trigonometrical work with the Bald Peak signal and primary triangle, by means of the signal of the assistants stationed there. We watched and signaled in vain; there was no response, yet the work was at length successfully executed. The theodolite telescope rendered visible not only the automatic stan-helio signal upon Bald Peak, but also that upon Mt. Hurricane! Most of the more important angles were now carefully remeasured and many new points determined. Two assistants were stationed with barometer at opposite points on the summit, the height of the peak above their station being found by spirit level, and their continuous observations during the day, taken at intervals of five minutes, formed a portion of the data from which the mean height of Marcy by our measurements is determined. From 222 selected observations taken at different times I have found the *mean altitude of Mount Marcy* to be 5,402$\frac{65}{100}$ *feet* above the level of mean tide in the Hudson river.

Indications of approaching storm made us work diligently all day and till after sunset, for the loss of an hour now might cost hundreds of dollars in pay of men, etc., during a dreary period of waiting for one clear day, a period which should properly be occupied in the march to the next station.

It was nearly dark when we hastily packed our instruments and commenced to descend, and we now added to our previous adventures the first descent of Mount Marcy in the night. Down the ledges and the oozy "slide," path of an avalanche, we groped our way, and once in the forest, lighting our lanterns, we went easily down to our camp.

August 26th.—We were surprised to find the morning bright and apparently favorable, the steady fall of the barometer during the previous day having led us to expect a storm. Leaving one assistant with barometer at Panther Gorge station, I set out for the summit of Mount Haystack, the third mountain in height in the State of New York, to effect its first *direct* measurement, by barometer on summit, and to occupy it as a trigonometrical station. No trail, no mark of axe on tree, here indicated that man had ever ventured before even on the lower steeps of this proud mountain; though one or two have claimed to have scaled it. Ascending Bartlett mountain, we selected our

course, and clambering amidst cliffs, slowly found our way, and cut a trail up the southern end; on this side, apparently the only place where this Matterhorn of the Adirondacks could be climbed. At length we came to the dwarf forest, so dense that it was almost impossible to tear a passage through it; then towering crags defied us, but defied in vain. By 11 A. M. I had the theodolite set upon the pinnacle rock, only in time to take a glimpse of the vast prospects, for close by, northward, was a snowy wall of cloud a thousand feet in height, which in another instant enveloped us. The day was lost to us, save the measurement of the mountain by barometer, and that in the greatly disturbed state of the atmosphere was unsatisfactory. The barometer — the small aneroid — of the near lower station, in Panther Gorge, failed to act satisfactorily, and the addative quantity for this measurement, probably 80 or 90 feet, was not obtained with accuracy. The height (lacking this + correction) indicated, by direct comparison with the Dudley Observatory, is 4,948 feet. We descended at 4 P. M. leaving the heavy instruments in their cases, in a cavity in the rock at the summit. The guides cleared a trail by following which future explorers can reach the summit of the mountain. At camp I found the guide from Keene Flats with provisions, with another guide sent as a messenger to one of my best men, demanding his return to the settlements. I could not spare the man, and needed more assistance; I hired and retained the messenger also. He proved an excellent and faithful worker. August 27th.—The reinforcement of my party by the new man, enabled and decided me to adopt a plan which I had been considering. It was now nearly September, and it was evident that unless stations were prepared, and signals set in advance of the survey party, there would be great delay. I, therefore, determined to despatch an assistant and one guide for this work. Written orders were prepared with map sketch showing the stations and work to be done. To this labor assistant Blake was assigned. He was directed to proceed to Long Lake, Hamilton county, there to hire and organize five (5) signal parties. He was individually to see to signal on Owl's Head mountain, and to engage a signal man for the station; he was to fit out with signals (heliostat) parties for the following stations:

Buck mountain; mirror and automatic signal, and camp equipments.
Smith's mountain; (Beaver river) automatic signal, " "
Grave's mountain; (Bog river) automatic signal, " "
Owl's Head mountain; (Long Lake) automatic signal, " "

Provisions, boats, etc., for parties also to be seen to. This done he was to organize a party of choppers and march them to the crest of Blue mountain where they would encamp until the summit should be properly cleared for triangulation work. An automatic signal was to be erected, and at a fixed day, he was to return to Long Lake, and with one guide assisting, take station, each with mirror signal at the extremities of a proposed base line on shore of Long Lake, visible from Mount Seward and from Mount MacIntyre, which last peak would be one of the theodolite stations for the determination of the extremities of the base line. Provided with funds, letter of credit, with full, explicit, and more extended orders; accompanied by his guide, he hurried off early, his course being over Mount Marcy to Lake Colden; thence to Lake Sandford, the settlements of Newcomb and Long Lake.

The day being clear — leaving the remainder of the survey party at work in Panther Gorge — I took with me two guides and reascended Mount Haystack, answering across the deep chasm the faint, distant shouts of the assistant now climbing Mount Marcy on his way to Long Lake. A day of brilliant sunshine on Haystack enabled me to accomplish a great amount of valuable work. The telescope of the instrument at one time showing the automatic signal on Mount Hurricane, and at another, at a sharp vertical angle, making visible the yellowish, lily-leaved surface of the water in the Au Sable lake, feeding ground of the wild deer by night, and again sweeping southward and bringing into view mountains beyond the hills of Schroon.

Copper bolt No. 11 was set in the rock beneath the theodolite, and distinguishes the station. The barometrical work, most important, was the measurements, with aid of level, of Basin and Gothic mountains. The height of Basin mountain, *never before measured*, is 4,905 feet, Gothic mountain, *also never previously measured*, is 4,744 feet in height. These stupendous mountains — majestic landmarks of the State — had until this time remained unknown to surveys, though all three are superior in altitude to the famous Mt. Seward. The angular measurements from the summit of Mount Haystack on this day afforded also the final basis for the geodesical measurement of numerous other lofty peaks, prominent among which is a peak known to the guides as Saddle Mountain. I have computed the height of this mountain trigonometrically, by the logarithms of its distance (as determined by my triangulation), and of the vertical angles measured, and find it to have an altitude of 4,536 feet above the sea.

Busily engaged with the angular measurements, the sketching of reconnaissance maps, etc., we worked till late, and descending the sharp crag reached camp.

August 28th.—I had devoted to the climbing of MOUNT SKYLIGHT, which had never before been ascended, even by the hunters or guides, though the fourth mountain in height in the State, as I have proved. Its slopes have been deemed almost impregnable, owing to the denseness of dwarfed trees crowding like a thicket of bayonets and fishhooks upon the steep rim and top of the mountain. Without trail or mark to guide us, we set out, and climbing to the rim, fought our way through all impediments to the summit. The mountain was measured barometrically, and the height corrected by synchronous observations at lower station in Panther Gorge, is by this *direct* measurement 4,967 feet. Numerous angles were measured and the reconnaissance sketches of topography made, have aided in completing the topographical map, showing the contour of Mount Marcy and the neighboring peaks inclosing the Summit-Water lakelets, the highest pond sources of the Hudson.

A little before 4 P. M. we put up the instruments and set out westward to explore the plateau south of Mount Marcy, where we had last season found the little lake Tear-of-the-clouds to be the loftiest water in the State, as well as the lake-head of our great river.

As we descended Skylight, we reached the level of the peak which I have named Mount Redfield, in honor of the discoverer of Mount Marcy. My measurement makes it 4,688 feet above tide. Moving rapidly toward a marsh which lies on the high plateau at the foot of this mountain, we were the first to reach, as we have been the first to

map the second little pond, shown on the topographical reconnaissance map. The barometrical measurement indicates its height above tide tide to be 4,312 feet. The little pool is margined and embanked with luxuriant and deep sphagnous moss, and we named it Moss Lake. It was found to flow to the Hudson. As we stooped to drink from this pellucid and cold spring, offspring of this high mountain atmosphere, my eyes were startled by the sight of some very small and beautiful white bivalve shells upon the bottom. They were about three-sixteenths of an inch in diameter, and were the first of such shells I have ever met with at such an altitude. Beautifully minute and white, representatives of a race of lake dwellers, it seemed to me that this circumstance alone gave this spring-like pool the right to the title of lake. In what manner this little bivalve shell ever reached this lonely water, elevated so near 5,000 feet from sea level, it is impossible to determine. Carefully I secured specimens in a phial with water of the lake, and hastening as night approached, crossed the plateau northward to the little summit lake "Tear-of-the-clouds." The measurement which I now took, affirmed my previous result, showing this water to be 4,326 feet above the sea, leaving it superior to its companion spring, the Moss pool, which I had thought might prove to be higher than the first one reached.

We here selected the route for a new trail over the mountains which would avoid the necessity of climbing Mount Marcy. We explored the low pass between the head of the inlet of Lake Tear-of-the-clouds and the Ausable water, and found it an easy and perfectly feasible route. We descended rapidly along a rill that hurried, leap on leap, swiftly down to Marcy brook, and were in camp before dark, notwithstanding prophecies that we would have to make a night march of it.

All the work contemplated at this station was now accomplished successfully. We had even exceeded our anticipations, and in the first measurement of Mounts Haystack and Skylight, and in the verification of my discovery of the lake sources of the Hudson, had truly gratifying results. On the morning of August 29th the baggage and camp equipage were packed, and guides and surveyors alike shouldering the heavy packs and knapsacks, we set out for the summit of Mount Marcy, where, after another day's work, we intended to descend to the range westward, and march to Lake Colden the same night.

This brilliant day was the first appointed for signal men to be at the stations, twenty to thirty miles back in the wilderness (near and beyond Long Lake), and, as burdened with the baggage, we slowly climbed, the guides shouted their hurrahs as they saw far beyond the intervening mountain ranges and lakes, on Owl's Head mountain, the sparkling flashing light of a mirror signal, which showed that the assistant had reached Long Lake, and successfully put my plans into operation. On the summit of Mount Marcy the theodolite was again set, and the angles between the distant signal and the automatic signals on Mount Hurricane and Bald Peak measured, with numerous others, as Blue mountain and MacIntyre, in connection.

Our extensive use of the barometer in leveling, had made the local meteorology of this region a necessary study to us; and in order to complete our knowledge of the atmospheric changes at this station during the year, I now made arrangements to determine the lowest winter temperature on Mount Marcy, which our experience had led us

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to suppose would be also the lowest temperature of the State. The large minimum recording thermometer, made by James Green of New York, was carefully adjusted and placed in horizontal position in the rock where, while open to the air, it would also be well sheltered from flying fragments of ice, blown about by the furious gales of winter. We secured the delicate instrument and reverently hoped that it might be preserved through all the vicissitudes of winter, and reveal to us in the spring and for the first time to the world, the secret of the arctic winter of our mountains. The curiosity of everyone will be excited to learn what the coldest temperature of the State may be, but to us the comparison of the result, with the records of other stations, will be of practical value, while the scientific student of the laws of atmosphere will perhaps be able, with a new fact, to rectify old theories and arrive at new results in regard to climate and the cause of storms.

After additional topographical work and forty additional barometrical observations on the summit (since used in determining the mean height), at 4 P. M. we descended on the west side of the mountain. At morning we had sipped the head waters of the Ausable, an affluent of the river St. Lawrence; now we quenched our thirst at the milky cataracts of the Opalescent river, the chill mountain torrent head of the Hudson. We reached Lake Colden before dark; and after reconstructing the bark shanties and making camp as comfortable as the circumstances permitted, fell asleep on beds of balsam boughs, whose rich, spicy odor perfumed the air. The maximum temperature of the day as recorded was 65°.5 Fah.

August 30th was devoted to a careful re-leveling of Avalanche Lake, with Lake Colden as lower station. An assistant with mountain barometer was posted on shore of Lake Colden, while I proceeded with one companion to Avalanche. Here we were surprised to find that the log canoe or dug-out (the construction of which had cost us such labor last year) was gone. While I went on with the leveling, my companion made search even to the further end of the lake, but was unable to find the boat. Returning to Lake Colden in the afternoon, and taking a barometer to Calamity Pond, leaving the assistant still stationed at Lake Colden, and I was now able to secure a direct comparison, which, with subsequent observations, affords the following mean results:

Lake Colden above Calamity Pond $58\frac{22}{100}$ *feet.*

Avalanche Lake above Lake Colden $86\frac{05}{100}$ *feet.*

The mean altitude of Lake Colden, by our measurments, is $2,770\frac{32}{100}$ feet above tide, and the height of Avalanche is therefore 2,856 feet. In our endeavor to measure both these lake elevations in one day, we were so belated as to be compelled to make a night march from Calamity Pond back to camp. Moonlight glimering down amid the dark evergreens, gave a singular and deceitful appearance to the tangled woods.

August 31st was a day of dense fog and cloud, the rain descending at times in torrents. We succeeded, however, in effecting some measurements by leveling. The storm was the more vexatious, as this was one of the days on which my orders prescribed that the signal men westward should be on their mountain stations, and on a single day of storm might depend the angular measurements from MacIntyre,

and on these possibly the determination, or success, or failure of the locating of the great landmark mountains of the western part of the wilderness. Gloomily we looked upon the pouring rain and the black, sputtering and half-extinguished camp-fire as the dreary night enwrapped us, and chilled and damp, we folded ourselves in the heavy blankets and turned as a refuge to sleep.

September 1. The storm still continued and we were kept close in the narrow compass of the bark huts. Spreading the maps upon the blankets, with the theodolite box for a table, angles were platted and station points marked on the field draft; so that we would be able to take advantage of our latest labors, and on resuming the topographical work would have newly determined points around which to fill in the minor notes of mountains, hills and lakes.

September 2. The barometer indicated clear weather, and I determined immediately to ascend Mount MacIntyre, which rose amid the clouds three or four miles north of our camp. In order to make a direct comparison of height between Mount MacIntyre and Mount Marcy, I sent an assistant, with guide and mountain barometer, to Mount Marcy, with orders to take observations at intervals of five minutes during certain hours. I expected to be on Mount MacIntyre, and exactly at the same instant take observations on the other mercurial barometer. We were off early in the morning — the assistant by trail about seven miles to Mount Marcy — and myself to plunge into the dense forest and find a route to the summit of MacIntyre. The course which I had followed in ascending Mount MacIntyre in 1870 had been at the time found so laborious that I determined to search for a more practicable route, for it must be remembered that there is no trail up this solitary mountain. Crossing the outlet of Lake Colden upon the boulders which rose above the shallow, crystalline water, we made a quick march along the west shore of the lake and entered the defile at the mountain foot, to which we have given the name of the Caraboo pass, being one of the unnamed principal defiles where the Hudson and St. Lawrence waters part. Here we came upon a new and beautiful waterfall, leaping sheerly down between walls of rock. In mid-air, spanning the chasm, was a fallen tree, dead and barkless; it was a crossing place for bears, and we named this water-leap, Bear-bridge falls. Deep in the defile we were surprised to find a rich little oasis meadow of "blue joint" grass, which, thick and rank, rose to our elbows. It was full of paths made by deer, and cosy beds from which they had only risen at our approach. A discussion which ensued as we climbed the mountain side in regard to the American reindeer or caraboo, was the occasion of our naming the new pass after an animal which once inhabited the region, but which is now, probably, here extinct. Much time was taken in selecting the route for the trail, and on the summit the wind proved extremely cold and violent; yet we were able to secure a barometrical measurement, and though the wind so shook the theodolite that nothing could be seen through the telescope, and no angular work could be done, all the spare time was occupied in entering in the large theodolite book, in their proper places, the names or titles of stations, mountains or lakes, etc., which were to be measured upon on the following day. Leaving the theodolite and barometer hidden in a cavity in the rocks at the summit, we descended at nightfall and marched back to our camp at Lake Colden. Our provisions,

which had been almost exhausted, were to-day slightly replenished by the return of a guide sent to one of the settlements for a supply. The maximum temperature on Mount MacIntyre was 47.5° Fah. On Mt. Marcy it was 48° Fah. The minimum temperature was much lower.

September 3. With two guides I again made the ascent of Mount MacIntyre — a toilsome climb — by the route selected the previous day. The assistant was again sent to Mount Marcy, and to-day we were able to make the direct comparative measurement of the mountains by synchronous readings of the barometers upon each of the summits. Gazing across the void between us and Marcy, miles across eastward, the flash of a mirror signal told us that the assistant was at his station, and now, as though side by side, simultaneous observations were taken upon the summit of these royal mountains. From the direct comparison, at 1:30 P. M. on this day, I have computed the following results:

Mt. Marcy (mean height), 5,402$\frac{65}{100}$ feet above tide.
Mt. MacIntyre, 1.30 P. M., Sept. 3d, 5,202$\frac{62}{100}$ feet above tide.
Mt. MacIntyre below Mt. Marcy, 200$\frac{05}{100}$ feet.

By the many different measurements of Mt. MacIntyre during the week, the above results remained nearly unchanged, the final mean altitude of MT. MACINTYRE BEING 5,201$\frac{80}{100}$ FEET ABOVE TIDE.

Besides the direct measurement of Mt. MacIntyre, angular measurements were made from the summit, the position of the theodolite being distinguished by copper bolt No. 12 firmly sunk in the rock, the number and title "Adirondack survey" being stamped in the metal. Night was now so close upon us that we were compelled to desist for the day, and again bestowing the instruments in a sheltered place in the rocks, we were enabled, thus unincumbered, to make such a rapid descent of leaping, jumping and breathless down-hill running, that a little after dark we were again on the solitary shores of Lake Colden. Slowly gliding across the lake on a raft that we had made, the moonlight gleaming on the dark water, and on the silvery clouds that hung around below the rock crag we had left, it seemed hardly possible to us that from that towering height we could have made so rapid a descent.

September 4. Arising early to prepare for a third and last ascent of Mt. MacIntyre, we found that a storm had set in, and it being quite certain that it would continue during the day, I sent two of the men out to the nearest settlement with orders to purchase provisions sufficient to last us till our work at this station should be completed. Unable to do any thing in the rain, we kept within our bark wigwams during the morning, but finding at dinner that the little store of food left us was almost gone, I set forth with one guide to explore the shores of the lake in hope of finding at least a grouse on which to try our pistols. Near the head of this lake we found some ducks, but they were wary and took wing. In endeavoring to creep upon them we startled a fine deer which also escaped us. Back to camp and a cheerless night.

September 5. The storm still continued, but the pocket aneroid showing a considerable and constant rise, gave assurance of approaching fair weather. It was late afternoon when the men dispatched for provisions made their appearance marching slowly with their loads.

September 6 proved clear and bright as anticipated. Taking with me but one man to the ascent of Mt. MacIntyre, I gave orders that the

rest should move the camp during the day to the meadow in the Cariboo Pass north of Lake Colden. This would be a step out northward toward the North Elba settlements, and would be more quickly reached by us in our next descent from MacIntyre. Leaving an assistant with barometer at the shore of Lake Colden I again ascended MacIntyre, and the day being clear and pleasant, completed the trigonometrical work. Mt. Hurricane was the zero of measurement, and there still glimmered the automatic signal. The angular distances between all the well-known peaks were measured and remeasured, and numerous secondary triangles constructed by crossing lines upon minor points: summits of small mountains, or rocks and islands in lakes. Westward beyond Wall-face Mountain, we looked down upon a mass of mountains, peaks and ridges, where the present maps show a plain; and further north the theodolite looked upon the bright surface of the lower Saranac, and the telescope slowly traversed in measurement from jutting points to the extremities of islands, to green headlands and wastes of burnt forest. Now the sight leaped to distant peaks in Franklin county, far beyond the rolling sea of woods, now lingered on flashing lakes nearer, then in Essex county Whiteface Mountain rose, and far beyond it in Clinton county were other peaks. In the large theodolite book, 26 pages contain the angular measurements covering over 200 stations observed on from this peak alone. The completion of this with the topographical and barometrical work, took all this third day on the mountain, and the sun had set before we had the theodolite packed. As soon as we got to the east side of the peak, it was night, and myself and guide were evidently "in for it." The night descent of MacIntyre was more than dangerous. Amidst ledges which daylight only had taught us how to climb, we crept down to the verge of towering cliffs, to escape which we had to reclimb, and as wearied and hungry we stopped to rest in the wet moss, nothing kept us from feeling miserable but the knowledge that this was the consequence of a successful work, and we felt a glow of pleasure as we thought that we had used every particle of the fair day afforded us. Storms and clouds might now enwrap the crest of MacIntyre for aught we cared, for our work there was done. Hurts received this night in a fall from a ledge during the descent gave me some pain, but at length we reached the bottom of the pass, and after a little search found the new camp near a brook which meandered through the forest at one side of the meadow. Here, a brilliant fire, cordial greetings from the men and the assistant who had been engaged upon the lake work, with a savory supper, made us forget our recent dangers.

September 7. Ascended to the summit of Cariboo Pass and took barometrical observations from which the height of this divide between St. Lawrence and Hudson waters is computed at 3,662 feet above tide. It is evidently a thousand five hundred feet too high to form a convenient railroad pass. By a rapid march through the unknown forest we reached the main branch of West Ausable river before night. Then striking the trapping line (marked trees), the course we followed in 1869 when marching from Avalanche Lake, we concluded to make a push for Clear Pond even if it took a night march; for now on a trail, with aid of our lanterns, we could proceed with little difficulty. Accordingly, we set out and made a hard march, the trail being obscure and much fallen timber in the way. Reached Clear Pond about 10 P. M.

September 8. After executing topographical work, the barometers were set up on the shore of the lake and a series of observations taken from which the altitude of Clear Pond has been computed at 2,159 feet from tide, being the first measurement ever made. The work completed, we again shouldered knapsacks and commenced our march for the settlements of North Elba, which we reached at dark that night. Here we found the baggage which I had ordered forward from Keene Flats, when we first entered the forest about a month previously. At night the close rooms, even with the windows open to the frosty September air, were a poor substitute for our bark shanties and blazing fires.

September 9. Paid off one of the men and made arrangements to re-enter the woods for work upon the Ampersand Pond section. Packed the heavy baggage again and sent it forward by team to Lower Saranac Lake, where we next expected to emerge from the remoter forests.

On the 10th assistant Manning set out by team with part of the baggage on his return to Albany. At the same time I proceeded by team with two of the guides to Averyville. Thence we moved to Camus Pond, the height of which, as a bench mark, I now determined by barometer, and found to be 1,991 feet from tide level. Here I was startled on opening one of the barometers, by the rattling of something within it. Unscrewing the cistern cap I found that the heads of some of the brass screws holding together the cistern had snapped off. The repair of this took us till late in the afternoon, but by making a forced march long into the night, we reached our goal and camped on the bank of Cold Brook, constructing a hasty bough hut for the night. During the day game appeared abundant, deer, partridges, etc., starting up before us as we marched.

September 11. We made a quick march from Cold Brook to Ampersand Pond, stopping only to measure the Ampersand Mountain notch, found to be 2,085 feet above tide.

September 12th was devoted to leveling and topographical work at Ampersand Pond — solitary lake, locked in by mountains and seldom visited. There was no boat upon its surface, and in order to complete the hydrographical work, we had now, of necessity, to try my portable canvas boat, which had hitherto done service as bed or tent. Cutting green rods for ribs, we unrolled the boat and tied them in, lashing poles for gunwales at the sides, and in a short time our canvas canoe — buoyant as a cork — was floating on the water. The guides, who had been unable to believe that the flimsy bag they carried could be used as a boat, were in ecstacies. Rude, but efficient paddles were hastily hewn from the nearest tree, and soon we were all gliding in our ten pound boat over the waves of Ampersand, which glittered in the morning sunlight. To the guides, the boat was something astonishing. They could not refrain from laughter, to find that they were really afloat in it, and pointed with surprise at the waves which could be seen *through* the boat, rippling against its sides. With the aid of the boat, with prismatic compass and sextant, I was able to secure an excellent map of the lake, and we almost succeeded in catching a deer, which was driven into the lake by a strange hound. The dog lost the trail at the water, and desiring to put him on the track we paddled to him. He scrambled into the boat with an air of satisfaction as if he had

always traveled in just such a thing. Soon he had regained the trail, and making the mountains echo to his voice, again pursued the deer on into the trackless forest. Continuing our work, we passed down into the outlet, where, in trying to effect a landing, we suddenly came face to face with a large panther, which had evidently been watching us. Our pistols would have been but a poor defense had the creature rushed upon us, but he fled at our approach. Barometrical observations were taken, but the height of the lake was better determined on the following day. From the open lake we carefully examined the steep sides of Mt. Seward — which like a dark wall closed the southern view — and decided upon a route for its ascension on the morrow if the weather proved favorable. At night the hooting of owls in the forest, and the shrill mournful cry of the loon on the lake, made our camp lonesome and solitary. At midnight we were awakened by strange distant howling, indistinct in the dash of the waves which a high wind sent foaming upon the shore. Out in the moonlight listening, we could hear it nearer and nearer till at length the lost hound rushed among us overjoyed to find human company. He seemed famished and devoured some scraps of biscuit with avidity. Heard more howling, which we thought might be wolves, but being tired fell asleep.

September 13th was stormy. The summits of the mountains were hidden from view, and it grew cold. A series of barometrical observations taken to-day on the shore of Ampersand Pond indicate that it is 2,078 feet above tide level.

September 14. It was still stormy and quite cold. A glimpse which an opening in the clouds afforded showed us the forest on the slopes of Mt. Seward whitened with snow. The barometer was still falling, and there was every indication of the continuance of the storm, and as our provisions would be exhausted at midday, I reluctantly gave up the contemplated reascent of Mt. Seward. We had, however, found that from Ampersand Pond, the climbing of Seward could be made with ease in a few hours, but the days of storm had already encroached upon more important work ahead. Our baggage was quickly packed, and the temporary frame of the canoe having been taken out and thrown away, we rolled up our boat and put it in the bottom of a knapsack.

Notwithstanding a pouring rain, which our rubber covering — torn and worn — did not keep out, we made a good march, and the same day by noon reached Cold Brook again, here navigable. In an hour and a half we had reframed the canvas, cut out two paddles from a dry cedar tree, had dinner, loaded the boat and were off, easily gliding down stream to the Saranac river. Three men, the heaped baggage in the center, and the solemn hound, who seemed to consider himself part of the company, sitting upright near the prow, forming in all a burden of about one-third of a ton, was a severe test of the green boughs of which we had made the frame. Ascending the Saranac river, we struck out into the broad Saranac lake, some six miles in length, and though the winds and the waves buffeted us, the canvas sides of the boat responding elastically to each beat of the waves, we got safely along till near the Sister Islands, when the wind blowing very fresh, the white capped rollers began to pitch into the boat. The exertions of the guides brought us under the lee shore, and at evening we disembarked at Martin's.

Photographed on Ground Lith. by Ward, Parsons & Co

BLUE MOUNTAIN

Middle chopping - rendering visible the Mountain Peaks necessary for measurement

September 15. One of the Keene guides was paid off and returned to Essex county, the canvas boat was again disframed and rolled up, and the baggage conveyed in two lake boats. I proceeded by the Saranac and Raquette river to Long Lake, which we reached on the 16th inst. We pushed forward with the more haste as I began to grow anxious to know what progress the advance parties had made. At Long Lake I found the assistant* and guides at their stations. All the preliminary work which I had ordered executed had been fully accomplished, the different points having been successfully reached by the signal parties and automatic signals erected. Great difficulty had been experienced in securing materials for signals. No sheet tin was to be had, but some large new conical tin pails had been purchased and from them the signals were made. At different stations sufficient choppings had been made for signal purposes, and on Blue Mountain it had been found necessary to make a clearing of many acres. This was only accomplished by many days of labor, the provisions being carried in packs to the summit, and a shanty constructed there. Not having enough signal mirrors, they had been favored by Mr. Kellogg, of Long Lake, with the use of the glasses from the rooms of his hotel, and thus, by various expedients, had they successfully accomplished most of the work ordered. Altogether eight or nine guides had been engaged in this work, and had labored intelligently and faithfully.

September 17th proving clear, and there being indications of fine weather, I set out at once with one assistant and guides for Blue Mountain, to execute the theodolite work for which the clearing had been made. Took boat up Long Lake, and ate dinner near the inlet, kindling our fire in a little level glade near the stream. Carrying our boats, baggage and instruments we reached South Pond and there encamped. The height of South Pond by barometer is 1,769 feet above tide. A careful reconnaissance map of the lake was also made, the meridian being determined with the azimuth compass.

September 18th we left our camp, and hiding our boats at the lake shore climbed to the summit of Blue Mountain. We stopped on the way to take the altitude of *Evergreen Pond* (so named by my men), and found it 1,980 feet. It is a pool unknown to the maps. The altitude of Mud Pond was also taken, and is computed at 1,968 feet.

At length we reached the summit of Blue Mountain. The clearing was extensive, and was an evidence of great labor. The assistant having given his immediate attention to the work, as directed, it had been cut in the exact spot and manner prescribed in my orders. The view northward was beautiful, the cluster of high peaks surrounding Mt. Marcy, sharp in outline, were whitened, as with snow, and between us and them was stretched a dark billowy sea of lesser mountains, among which we detected familiar mountain landmarks, from here appearing changed and new. At the east, our more southern stations were visible — Van de Whacker Mountain and the Chain Lakes — and southward, through a long lane cut in the timber, Snowy Mountain, our discovery of last season, was seen, and the level here showed, as we had previously proved, that it was indeed higher than Mt. Emmons. The point where I now set my theodolite (distinguished by copper bolt No. 14) was north of the station occupied

* Detached in August.

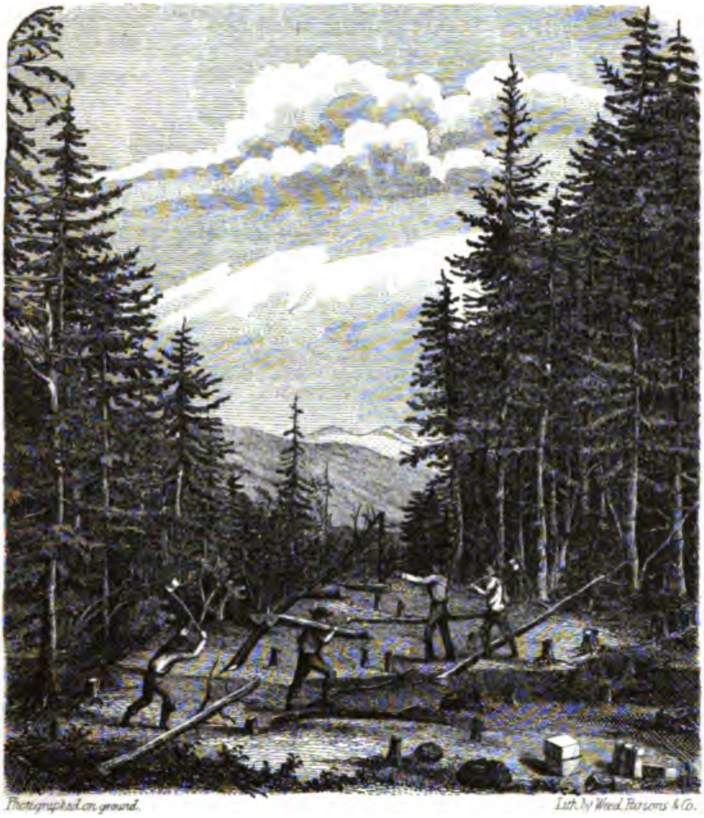
in 1870 (at the time when the first hasty measurement of Blue Mountain was made) and higher. It was, therefore, very satisfactory to find that our conclusions as to the superiority of Snowy Mountain were fully sustained. The mean of the barometrical observations taken this day upon Blue Mountain show its height to be 3,824 feet instead of 4,000, as so long represented. Forty-eight observations on the barometer, and 96 thermometric readings represent the hypsometrical work on Blue Mountain.

While I carefully made the angular measurements of the peaks north-west, north and north-east, the axes of the guides were active among the dense timber which obscured the view westward toward Raquette lake. Their method of chopping was economical of labor. A row of trees in the desired direction, thirty or forty in number, were first chopped more than half through, then the innermost was felled against them, and, with a grand waving of their tops, they sank outward together striking each other to the earth with one great crash; then in place of the blank inclosing wall of evergreen trees, an avenue of daylight appeared, disclosing in the distance more mountains, more lakes, new and surprising bits of topography, and new opportunities for measurement. Soon Raquette and Blue Mountain Lakes were brought into view, and their points and islands measured upon with the theodolite. Night overtook us before we could do all that was desired, and we had left provisions, blankets, every thing, far away at the South Pond that we might be in light marching order.

The camp or shanty built by the chopping party was near by, but as we had no provisions, and did not desire to pass a cold and hungry night, we decided to attempt the descent on the south-west side, to the shanty of a hunter, an old guide of mine, on the shore of Blue Mountain Lake. Covering the theodolite and barometer with rubber cloth, we set out unincumbered. The night proved very dark, and, though aided by our pocket lanterns, the descent was long and tiresome, our candles being almost all burned when we emerged upon the sand beach at the shore. Quick and repeated discharges of our revolvers at length brought hunter and boat to our assistance, and we found the hospitalities of his bark hotel as elegant as those of more pretentious places.

The following day, September 19th, proving stormy, I decided not to reascend Blue Mountain, but sent the assistant with one guide to the summit for the instruments left there. The barometrical leveling indicated that Blue Mountain Lake is 1,821 feet above tide level. It is interesting to compare this measurement with that which I made in 1870 at the same station, from which the height was computed at 1,814 feet above tide. These form the only measurements of the altitude of these lakes thus made, and are now for the first time published. Some valuable additions were made to the map of the lake, then striking across by Minnie Pond — height 2,131 feet — we struck the line which we had marked on the trees as we ascended Blue Mountain. Here we took a hasty lunch, standing in a furious rain storm, and being rejoined by the men from Blue Mountain hurried back to South Pond. Our trail, the first marked line to the peak from this side, and our hut near the top of Blue Mountain may be of use to any one desiring to visit the summit.

Rowing swiftly across South Pond — leaving there one boat — we reached Long Lake settlement again the same night.



Photographed on ground. Lith. by Weed, Parsons & Co.

ON BLUE MOUNTAIN

Timber cutting for view of Snowy Mtn and triangular measurement.

September 20th. Though every hour was golden in value to us (the Adirondack winter threatening soon to set in), I found it would now be necessary to close the work of the second division.

Fifty days in the wilderness without any communication with head-quarters would leave a great accumulation of business.

The whole of this day was occupied in paying off men, settling up accounts, etc.

On the 21st, we took team and reached *Aiden-lair*, Essex county, the same night.

The elevation above tide of a station here, by barometer, was 1,700 feet.

On the 22d, a long and tedious drive brought us to the head of the Adirondack railroad, and we returned to Albany the same evening via Saratoga.

Various accumulated work now demanded my attention. In addition, the preparations for the third division of the field-work had to be made. Our camp blankets had for sometime been but partial comforters, and new double army blankets were procured. Large rubber ponchos were provided for use in place of a tent, and numerous other equipments prepared or repaired as suggested by our experience. The injured cistern of barometer No. 1987 was repaired and the instruments re-adjusted so as to read together. Such additions and corrections were made on the working maps as were suggested or made necessary by our last work. Working charts of Lake Champlain, prepared with the greatest care — from the Archives of the United States Coast Survey in Washington — had been forwarded by the draftsmen employed, and with new data (of stations on the lake shore) I was now prepared to complete the work at the Bald Peak angles which had been reserved until the receipt of this new material. We were at length prepared for the last labors of the season.

FIELD WORK.

THIRD DIVISION.

The third division of work was to cover the final measurements from one or two light-houses on Lake Champlain, at Crown Point, and also at Plattsburgh, which had not as yet been made a triangulation station, though it afforded many excellent opportunities for work upon distant interior mountains, as yet not connected with the coast survey work by direct measurement. The interior region to be covered was that of the Saranac and Tupper lake regions, with the exploration of the remote section lying beyond the sources of Bog river, where arose the mingled affluents of the Oswegatchie and Beaver rivers. I proposed to ascend and occupy, as theodolite stations, Ampersand Mountain at the east, and Grave's Mountain at the west; and, as the limit of possible work, hoped to be able to advance the triangulation so as to determine some point or points in or near Great Cranberry Lake in St. Lawrence county. If the weather permitted, Mt. Morris and St. Regis Mountains would afterward be occupied as stations for theodolite, as commanding the Tupper's and St. Regis Lake systems, and affording an opportunity to cross lines already measured on points in their vicinity. We were well aware that winter would overtake us while

engaged in this work, but knowing the usual steadiness of that season of the year in the Adirondacks, hoped to find the winter useful in freezing solidly the otherwise impassable swamps, and enabling us to work even upon the frozen surface of the lakes.

On October 6th, we were at Plattsburgh awaiting the clearing away of a storm which prevented our making the measurements between the coast survey stations and our mountains.

On the 7th, it continued stormy or cloudy until afternoon, when some of the mountains appearing, we took boat and reached the light-house on the break-water before Plattsburgh.

Here, from the top of one of the towers, with a distant light-house as zero, I was able to turn off an angle, having for the point of sight, a point on the sharp summit of Whiteface Mountain, visible, far distant, in the south-west; and afterward repeating the same work from another light-house, using the first as zero, directly connected our station on that mountain with the coast survey work. The astronomical coördinates of these light-houses having been furnished me by the coast survey, made this work the more valuable. Other mountains were also measured to, by horizontal angles, the most notable of which was Lion Mountain, in Clinton county.

October 8. We proceeded by rail to Point of rocks, and thence by team — thirty-six miles — to Martin's on the Lower Saranac Lake. Here men and boats were procured, and others engaged, and on the 9th we went forward to Bartlett's, at Round Lake, in order to be near our next station, Ampersand Mountain. During the day a theodolite station on an island midway in the Lower Saranac Lake was occupied. From this station — already measured upon from Mount MacIntyre — we were able to radiate many lines to important points — the extremities of the Lower Saranac, its islands, points, bays, and neighboring peaks — all of which would be afterward determined by the angles to be completed by measurements, from Ampersand Mountain. To render this island station visible from distant points, an automatic stan-helio signal of the first order was erected, and signal card posted. The station had been carefully selected so that the signal should be visible from Mt. Morris in order that from that mountain — whose summit had already been found by angular measurement — if afterward occupied by us as a theodolite station, we might be able to form as direct a connection as possible between Tupper's Lake and the Saranac.

On the morning of the 10th, we set out for the summit of Ampersand Mountain. Taking boat and descending the Saranac river into Round Lake, we landed on the east shore, where a marked line or trail leads to the summit. The transit instrument and provisions were carried by the guides; myself and assistant carrying the barometers. In the forest the snow, which had fallen some time before, lay cold and crisp, having thawed and frozen. The air was cold even at the foot of the mountain, and gave us assurance that our encampment on the summit would be cheerless. The mountain was easy of ascent, but the heavy baggage compelled us to move slowly. Here a slip against a rock broke in pieces a choice pocket thermometer which had been carefully bestowed in an inner pocket of my coat. We had now, therefore, only the two standard detached thermometers to depend upon in our hypsometrical work. We took dinner at a spring on the trail some distance from the summit, and establishing a bench mark.

found the height to be by barometer 2,960 feet from tide. Making our camp in a bark shanty on the crest, we commenced our labors. A small opening in the timber which had already been made on this summit, enabled us to determine how much of the forest on the ridge would have to be cleared before we could proceed with the work. This determined, the men immediately commenced chopping, and as tree after tree fell, and the view enlarged, the prospect became enchanting. By evening, excellent progress had been made, a sufficient horizon having been cleared, to enable me to commence the work of measurement on the morrow, there not being now even a branch to obstruct the field of the theodolite telescope when stationed on the exact peak for upward of 120° of the horizon. The view over the lake-land below, at night, was strangely beautiful. The silent lakes and sombre forests stretched away at the mountain foot, into the obscurity of night, or were lost under the shadow of some towering mountain. It being very still and the stars brightly visible, I was able with the transit to determine the magnetic variation (declination) by observations of the upper culmination of the star *a ursa minoris*. The scene, while this work was being executed, would have well suited the brush of Salvator Rosa. Upon the verge of the precipitous summit, was the glowing camp fire redly illuminating the open front of the bark camp, where the guides, in their hunters' costume, with shapeless felt hats, picturesquely reclining, looked out upon the fire or the depths.

Beside the shanty the transit instrument, carefully removed from the influence of iron or steel (pistols, knives or axes), with its standards and limbs of brilliantly polished brass and silver shining in the light of the lantern held by the assistant: the dark depths below, and the starry dome above, together formed a strange unusual spectacle. Thus we waited till the time of culmination of the star drew near — narrowly watching it through the telescope — reflected lantern light thrown within the tube, enabling us to bring it sharply on the cross hairs — then vertically downward — to find that it is not yet time by *Alioth*.—At length they are vertical — time-piece in hand, a few moments pass, then the cross hairs delicately center on the star, and the work is done.

The night passed quietly, and the morning of the 11th opening with brilliant sunshine, we were all astir on the summit before the first gleam of sunlight had reached the lowlands. While some of the men recommenced chopping, others pulled up the stumps from the thin, soft, "wooden soil," a sort of incipient lignite-peat, resulting from the decay of fallen trees. This "soil," when dry, will burn like tinder, and be utterly consumed. It was now wet and peat like, and digging into it about a foot we found the solid rock of the summit — upon which, perhaps, the sunlight had not shone for a thousand years. Shoveling the muck aside, a sufficient space was cleared for the tripod of the theodolite, and three holes were drilled in the rock for the reception of the tripod feet. The instrument was then set up, and the plumb bob indicating the center, a copper bolt (No. 13) was sunk in the rock. The sharp peak of MacIntyre, beyond a mass of intervening mountains, loomed up against the sky, and the telescope showing our station of Sept. 2d, it was made the zero of measurement. Then from mountain top to mountain foot, to hill and lake, the measurements traversed. South, deep at our feet — a dark mirror of green water —

was Ampersand Pond, and we could see the points and islands which we had reached with the aid of our canvas boat in September; beyond, rose like a great wall the vast mass of Mt. Seward and Ragged Mountain, with the *Ouluska* Pass, and far beyond Mt. Santanoni, and other lofty peaks. Farther at the right, in the dim distance was Blue Mountain, and between us and it Long Lake stretched in perspective, a gleaming avenue of water. Northward, in blue, hazy distance was Lion Mountain — other mountains and lakes intervened — and then before us was spread the Lower Saranac Lake with all its numerous islands and the intricate channels winding among them. There, sparkling on the shore of one island, we could see our automatic signal; and the angle between it and Mt. MacIntyre being carefully measured, and the third angle computed, was found to agree with the measurement made at that station. That station might therefore be considered as determined. Then, as the guides cut away more of the obscuring wall of timber, the Upper Saranac, and the St. Regis and other lakes appeared, and the more important landmark of that section, St. Regis Mountain, while, as the trees still fell before the axe, at length Mt. Morris was visible — forest covered from base to crown — with the bright expanse of Tupper's Lake shining at its foot.

At 5 P. M. it became evident that we would be compelled to remain another day on the summit, in order to finish the measurements — trees still hiding some of the points which it was important to determine, and the topographical sketching having yet to be done. We were already out of provisions, and two of the men were sent down the mountain to the boat with directions to return early on the morrow with supplies. Slinging their empty knapsacks they hurried away downward, while we returned to our work; and not having supper to prepare, we kept steadily on till dark, when the frosty night air made us gather around the fire. The instruments were taken down and repacked for the night. During the whole day the assistant took observations on mountain barometer (J. G., No. 1866), affording the data from which the height of Ampersand Mountain has been computed at 3,432 feet above the level of mean tide in the Hudson. The temperature, which during the day had been at one time as high as +75° Fah., was at 6 P. M. +53° Fah., and rapidly falling. The barometer, from a height of 26.702 inches at half past 9 A. M., descended to 26.519 at 6 P. M. At 4:50 P. M., the south wind which had prevailed during the day, became stronger and more gusty, having a velocity at that time — and as I determined by anemometer — of 814 feet a minute, or nearly nine miles an hour. A short time after the instruments had been put up the wind suddenly changed to the north and it grew rapidly colder, the gathering clouds northward threatening storm.

Just before dark there was an alarm of "game on the mountain," and the hungriest seized their weapons and commenced still-hunting. The game, a rabbit or northern hare, was, however, only seen once.

Wrapped in our blankets we endeavored to be comfortable, but the fire having burnt for itself a hole in the peat-like soil, afforded us little heat, and we passed an unpleasant night.

October 12. We woke to find the mountain top enveloped in a dense rain cloud. At 7 A. M. we could see nothing beyond the mountain, but we chopped away some of the trees previously marked as in the way of sight. At 9 A. M., the guides despatched on the previous day for

Drawn by Verplanck Colvin

Lithographed by Weed, Parsons & Co.

ON AMPERSAND MOUNTAIN.

Adirondack Survey Clearing Showing below Round Lake and part of the Upper Saranac Lake before obscured by the timber and now thrown open to measurement.

provisions arrived, and we made a hurried breakfast. The clouds enveloped us all day and we gave our attention to chopping. It was the third day of our stay upon the mountain, and by night we had nearly finished all the necessary clearing to the south-west and north. Night came down dark and very cold, and 7 P. M. it commenced to snow, and the storm, which we had predicted, came fiercely on. Toward midnight the rain became violent and gusty; the snow and sleet swept into the open front of the shanty, and we shivered under blankets thickly crusted with ice. The growls and exclamations of the guides endeavoring to keep warm, with their maledictions upon the fire, — which, despite a careful building up, had now quite entombed itself — continued through the night, and to the labors of the day they were compelled to add a midnight chopping of cord wood. About morning we deserted the inhospitable shanty, and hastily retreating into the woods out of the wind, built another fire and tried to keep from freezing. A slender breakfast in the snow, beside this fire, but poorly prepared us for the labor of the 13th. Warming our benumbed hands and feet at the blaze, we watched the eddying cloud — whitening and darkening in places as it rolled. Suddenly a mountain loomed through it, and by its form we recognized a subordinate peak of Seward. A guide sent to our station above, at length announced that the Saranac lakes were visible, and the transit was moved to the summit and work recommenced. Painfully it progressed, and at 5 P. M. it was completed, the Fish creek waters being the last measured upon. A stanhelio signal of the first order was placed immediately over the copper bolt, and as quickly as the theodolite could be packed, we were speeding down the mountain, hoping to avoid a night march. In this we were not successful, and for about two miles we moved by lantern light, guided by the marked trees. At the shore of Round lake we found our boat, and at 9 P. M. took supper at Bartlett's.

October 14 was devoted to barometrical observations at level of Round lake, from which the height of that water above tide is computed at 1,576 feet. The indications of an early winter were so apparent that I decided to immediately push on into the remote region at the head of Bog river, and finish the work there before the streams and lakes were frozen.

On October 15, having loaded our boats with the baggage and as much provisions as could be carried, we removed to the upper Saranac lake, where barometrical observations were taken while the guides superintended the carrying the boats and baggage across the divide to the Raquette river. The height of the Upper Saranac is computed at 1,605 feet from tide. Crossing from the Saranac waters to the Raquette river, we descended that stream to Tupper's lake, where we remained that night.

October 16 proved bright and clear, and was devoted to barometrical leveling. The boats and baggage were carried under the direction of one guide to Horseshoe pond, whither the assistant was also sent with barometer. Stationing myself with the other instrument at the shore of Tupper's lake, as lower station, at a given hour we commenced synchronous observations. From the data thus obtained I have computed the height of Horseshoe pond above Tupper's lake at 158 feet. The direct comparison with the Dudley observatory indicated local atmospheric disturbance at Albany, and I have since computed the complete

tidal height on the basis of the mean of the synchronous observations of the United States signal service at Oswego, N. Y., and Burlington, Vt.,* showing Tupper's lake to be 1,554 feet above sea level; but little different from the determination of last year. I rejoined my assistants the same day at Horseshoe pond — a lake of moderate size, gaining its name from its form — and we encamped that night near the outlet of the pond, a small stream southward to Bog river. By the barometrical work of the day we had risen at one step of direct measurement to the level of the Bog river lake country, keeping at the same time a firm hold upon and connection with our old measurements.

October 17. We had now with us only two guides, with two boats for the conveyance of ourselves and stores. The guides were skillful hunters, and had faith that we should be able to live to a considerable extent upon venison and other game. We had some trouble in getting the heavily laden boats through the narrow outlet of Horseshoe pond, but about 4 P. M. we entered the Chain Lakes and unloaded our boats at the north side of the Second Lake. Having no meat, though it was almost sunset, we determined to kill a deer for supper. Put out the dog accordingly, and in a quarter of an hour after the hound had uttered his first yelp we had shot a fine buck. Having now a whole carcass of venison, we felt reassured as to provision, and after supper, building a roaring fire, we fell asleep.

The morning of the 18th was bright and pleasant, and I determined to push forward at once and occupy Grave's Mountain, and if possible complete the angular measurements while the day was clear. I left the assistant with his barometer, stationed at the shore of Second Lake, near our camp, and with two of the guides, and one boat (carried on the shoulders), set out through the woods to Spring Pond. Crossing this lake we landed, and again made a carry, one of the guides "backing" † the boat and the other the theodolite. Launching our boat on Grave's Pond we paddled to the foot of the mountain which frowned grimly above us, a gray crest of rock from which the forest had been burnt away. Drawing the boat ashore, the guides shouldered the packs, and we immediately commenced again to climb. Upon the summit I was pleased to find in good condition the automatic stanhelio signal placed here by the advance signal man in August. It was constructed of two tin vessels — forming frustrums of cones — one inverted and the other upright. Though it had answered excellently, it was small, and was taken down to be replaced by a large first order signal, for which we had brought the material. Although it was bright and cloudless, and all our eastern mountain stations visible, a violent gale from the south-west made it dangerous and useless to set up the theodolite, for if no accident should occur, the shaking and quivering of the instrument would prevent any thing like a measurement. We, therefore, busied ourselves with the construction of stone shelter, under cover of which to bestow the instruments until our next ascent. This done, some attention was given to topographical sketching, but the violence of the gale, which had an apparent velocity of over fifty miles an hour, made it difficult to find any shelter where the maps and papers could be opened. Some valuable reconnaissance notes were, however, secured; and from a superior stand point we saw

* For explanation of method, see Hypsometry.

† Shouldering.

and located two new ponds or lakes, one of which, in a deep valley, with the trees upon its sheltered shores slightly reflected in its waters, was a pleasant contrast to the wild gale sweeping the mountain top. This gale was the more annoying to us on account of the gritty particles of the crumbling rock which it tore loose and swept into our eyes. This gravelly grit or sand originated in the softening of the rock by the fire which some years before had burnt away the timber.

After 2 P. M., the gale began to abate, and I was able to take barometrical observations synchronous with those of the assistants at Second Pond. From the data of the two stations I have computed *Grave's Mountain to be* 608 *feet above Second Lake.* Subsequently we made various measurements from which to obtain the mean height of Second Pond above tide, and the final result, which is as well stated here as anywhere, shows Second Lake to be 1,736 feet; and Grave's Mountain to be 2,345 feet above tide level. The mountain being nearly 300 feet higher than the Bald Peak of Moriah.

We left the mountain early in the afternoon, and returning to our boat took observations at the level of Grave's Pond, which, on comparison with the synchronous data of the assistant at Second Pond, indicate that *Grave's Pond is fifty-nine feet higher,* and consequently 1,795 feet above tide.

We had left the transit carefully packed in its box, with tripod, etc., all covered with canvas in the stone shelter or cairn built for it on the top of the mountain. We, therefore, made a swift carry to Spring Pond, and after crossing it, had time to take barometrical observations. The direct comparisons with Second Lake would *show Spring Pond to be* 72 *feet above* Second Lake, and 12 to 13 feet higher than Grave's Pond. We found the assistant still steadily at his work on the shore of the Second Lake when we arrived, and 73 careful observations taken at the appointed times were the record of his reliability and industry.

October 19 was stormy. A low pressure of the atmosphere indicated a continuance of bad weather, and it was therefore useless to reclimb Grave's mountain. Again stationing the assistant at shore of Second Lake, I proceeded, our guide carrying the boat, to Three-pound pond, and thence to the Hornet ponds. The direct comparison of observations which I took at Three-pound pond shows that beautiful little lake to be sixty-six feet above Second Lake. The exact altitudes are as follows:

Second Lake..............................	$1,736\frac{74}{100}$	feet above tide.
Spring pond..............................	$1,809\frac{01}{100}$	" "
Grave's pond..............................	$1,795\frac{28}{100}$	" "
Three-pound pond..........................	$1,802\frac{21}{100}$	" "
Hornet pond (about).......................	$1,786\frac{40}{100}$	" "

Topographical reconnaissance of the lakes gave us an interesting map sketch, showing three new ponds and the neighboring mountains. The barometer continuing to fall, and there being every indication that the storm would continue several days, I suddenly resolved to break up camp and move up to the sources of Bog river, and commence their exploration. This could be nearly as well done during the stormy weather as in fair, though not so comfortably. Hastening back to Second Lake, the boats were quickly loaded, and we left the lakes and passed up Bog river to Mud lake. Here we encamped with a party of guides, who had come in their boats with dogs a great distance to kill

deer for market, being the first party ever venturing in so far, for that purpose. This evening the barometer was still falling. There had been considerable rain during the day, and there was but little snow to be seen. All this night it rained.

The morning of the 20th found the fire drowned out and the bark roof of the camp leaking streams of water. It was with difficulty that any thing was procured sufficiently dry with which to kindle a fire. All day rain continued to fall, and also the barometer — the pressure extremely low, being some $\frac{8}{10}$ below the mean; at 8 P. M. standing 27.450. The storm was so heavy that we were compelled to keep under shelter. From the hunters to-day I learned that a trapper from the western side of the woods had penetrated a few days before to Mud lake, and had evidently come by way of some lakes or streams known only to himself. He was thought now to be somewhere two or three miles westward beyond the head of Mud lake, for they had heard the distant report of a rifle in that direction. This was the very region which I had designed to explore. On a very old chart in my possession I had noticed a lake placed at the corner of certain old survey lines, which lake had never since appeared on any map. My inquiries of the guides as to the location of such a lake had for years been met either with incredulity or professions of ignorance as to that most remote section; but feeling assured of its existence, I had come to call it the Lost Lake, for obvious reasons. Three years before my efforts to reach it when alone in the wilderness had been foiled by the failure of my provisions. I now decided to strike out into that unknown region on the morrow, and making a circuit through the forest of as many miles as we could in one day, endeavor to find the track or trail of that trapper, and, at any rate, gather topographical notes of that dubious region.

October 21. The sky is still overcast, and the storm has raised the water in the lake a foot or more, but it has stopped raining. Taking our boats and carrying a light lunch, we set out. The assistant was posted on the shore of Mud Lake with barometer, with orders to take continuous observations during the day. One boat also was left with him. Proceeding with the men to the upper end of the lake — a broad, soft, peat marsh, now partially overflowed — the boat was left, and with a glance at the compass, we struck into the forest. Paths of deer traversed the wood everywhere, and in the wet places we saw numerous tracks of wolves.

Pushing on into the forest, occasionally meeting doe and buck, so unacquainted with man that they scarcely deigned to fly, we kept a sharp look out for trail or sign of man, and from any slight eminence peered out through the leafless trees to see if we could discover any lake. At length we struck some rills or brooks, which flowing westward were evidently some of the head waters of the Oswegatchie river. Below some low hills shut in a valley, and suspecting water, I hurried down, and in another instant a new lake was shining before me! Here we discovered signs of the trapper, and one of the guides making search along the shore for foot-prints, found his canoe! Embarking, we crossed the lake, a small but handsome sheet of water. I surmised that this might be the lost lake, but deferred for the time the search for the survey corner. While drawing the boat ashore on an opposite sand beach, guns were heard in the forest a mile or two

south-westward, and we started directly toward them, making a running march. Heard no more guns, and after traveling, as near as we could judge, to the spot where they originated, we became involved in a dense swamp but found no one; nothing but silent woods. Marching as rapidly as we could we came at 3 P. M. to a descent where the country westward lay lower. The guides climbed trees, but could see neither lake nor smoke nor even recognize hills toward Mud Lake which we had left in the morning. Here we stopped a few moments to eat the mere handful of food we had with us, and of which our rapid march had before prevented our partaking. The sun was sinking. We had neither blankets nor provisions, and were ill prepared for a winter's night. Our march had been so rapid that there had been no time to keep an eye on the compass, we, therefore, took our return course by guess, and moved as rapidly as though acquainted with the country. Thus we ran suddenly upon another lake which we had evidently left far to the north in our outward march. Not far from it we found a wolf-trap set in one of the paths made by these animals, and we quickly found an obscure but sufficient trail, following which with all possible speed we reached again the first lake of the day. Here we had the fortune to find the wolf trapper and his companion and accepted the hospitality of their shanty for the night. We learned from them that the lake where we were now encamped was a good deer pond, and that the old survey corner was exactly where I had expected to find it.

On the following morning, October 22d, we found the corner, and I was satisfied that this was indeed the lake so long lost. But more than this, I learned from the trapper that there were many ponds and lakes known to himself and one or two other hunters which had never appeared upon any map, and of which he spoke reluctantly, as one revealing his hidden treasures of fur and game. The second little lake near which we had found the wolf-trap, was called Nick's Lake after one who had trapped there. The reconnaissance had been successful, and my mind was made up as to the further course of the survey. I determined at all hazards to locate all these new lakes this winter, and with my party push through and explore all the unmapped region from our present station to the Beaver river settlements far south-westward, as, indeed, I had originally contemplated. But I could not abandon the work commenced at Grave's mountain and its vicinity, whence I had planned to extend the triangulation to Great Cranberry Lake the same season. After a short mental computation of time for work, and chances of foul weather, I engaged the trapper then and there to meet me at the exact expiration of ten days to act as our guide, as far as his knowledge went in this district. Fearing that the men at Mud Lake would become alarmed at our absence, knowing that we had marched without provisions or blankets or even an axe, we set out early this day on our return, one of the guides preceding in advance, the sooner to assure them of our safety. At the shore of our lost lake I had taken barometrical observations on the previous day, which when compared with the synchronous observations at Mud Lake showed the lost lake, now refound, to be 16 feet higher than Mud Lake. The computations afford the following altitudes:

Mud lake............................	$1,745\frac{33}{100}$ feet above tide.
Lost lake............................	$1,761\frac{33}{100}$ " "

Reaching the shore of Mud lake we found that the advance guide had taken the boat and proceeded to camp as directed, but had not yet returned. On the opposite shore we could make out that the assistant was engaged at his work. Five rapid revolver shots — the signal, "boat instantly" — brought him to us swiftly, and embarking we proceeded to our camp. In the afternoon the assistant returned to the leveling station on the shore of Mud lake, while I took one guide and marched to Grass pond, of which, with the neighboring mountains, I secured a reconnaissance map, the angles by azimuth compass. The synchronous barometrical readings showed Grass pond to be only five feet higher than Mud lake, and 1,750 feet above tide level.

October 23. The morning was bright, and I ordered an immediate return to Second pond, for the resumption of work at Grave's mountain. The boats passed rapidly down Bog river and we disembarked at our old camp. On examining our stock of provisions there was found only a scant day's rations for the party remaining. One guide was, therefore, detached to return to the settlements for flour, etc.,

LATE NOTE. — Owing to my recent measurement of the heig[ht of] the Dudley Observatory (made since the maps, accompanying [this] report, were printed, by which it is found to be higher than reco[rded] in the Annals of that Institution), the altitudes shown upon the [maps] -- plates 6, 11, 19 and 20 — are all based upon a datum $36\frac{4}{10}$ feet a[bove] mean tide level in the Hudson river at Albany. See Appendi[x] p. 177. The publication of the report has been delayed in orde[r to] correct the altitudes throughout the stereotype to tide level.

ERRATA. — See description of this map in Appendix A.

[...]l before us, nothing intervening to hide the view or to prevent the [...]ar measurements connecting that water with our Lake Champlain [...], which lay far eastward beyond the distant serrate crests of Mounts [Se]ward, Marcy and MacIntyre and their kindred mountains. The transit theodolite was carefully adjusted, holes being drilled in the rock for the tripod legs, copper bolt No. 15 being sunk beneath the plumb. In the course of measurement the angle for Blue mountain was reached, and while the clearing we had made on that peak could be noticed even at this distance by the naked eye, our pleasure was great when the theodolite telescope made visible the gleaming, star-like automatic signal we had placed there. On Owl's Head mountain, also, we could distinctly see the automatic stanhelio signal, and from such zeros we now at one sweep of the telescope passed to Cranberry lake, and then measured angle after angle to sharp and unmistakable points upon its shores. A small solitary tree at the center of an island, a pointed

rock further west, and other spots, were in turn measured on, and then sketches of their form and place were entered under the head of "remarks" in the geodetic field-book. Thus one of the last works which I had hoped to accomplish that season, and which I had long feared might not be possible, had been brought nearly to its completion; for a few more measurements from another mountain would *determine* the position of the points in Cranberry lake, and enable me to plot the lake upon my final map, with direct reference to the distant Champlain base lines. Late in the afternoon the guide sent to make the carry with his boat, came up the western side of the mountain, shouting as he came that he had found two new lakes. It appeared that after leaving his boat at the appointed pond he had struck across toward our mountain, and while finding his way had come directly upon these waters. One was small and shallow. The second, which was deep and clear, having rocky shores and surrounded by hills clothed with dark evergreen forests, he had taken the discoverer's privilege of naming Lake Colvin. These ponds being unknown to any map, were therefore another addition to this year's list of discoveries. Clouds appearing at the horizon warned us to complete our work if possible this same day, but despite our utmost efforts night descended while more remained to be done. Again boxing up the theodolite, we made a hurried descent of the mountain, and stumbling against trees and rocks in the darkness, reached the shore of Graves' pond and our baggage, which we had left there. We had not even a bark hut, and, exhausted, lay down and slept on the mossy rocks, while the guide proceeded to gather wood and build a fire. With the light afforded by the blaze we set up poles, and throwing two rubber ponchos over them, commenced housekeeping. After a slender supper we wrapped our blankets round us, and lulled by the warmth of the fire crackling at our feet, and by the solemn hooting of an owl, who had stationed himself in a tree overhead, fell asleep.

Oct. 24. A meagre breakfast — almost the last of our provisions — was a poor preparation for explorative marching. The day being stormy as anticipated, we started on a march to Silver Lake, which I had set apart for such a day; and also determined to visit the two new lakes discovered by the guide. Leaving the trail, we crossed a ridge, the summit of which has a singularly long and regular wall-like front, whence we gave it the name of Rampart Mountain. After some search we found the ponds and took their altitude with barometer; Lake Colvin being 1,990 feet above tide; also securing reconnaissance sketches of their forms. Beside the smaller one we gathered some fine cranberries. There was no mark of axe or sign of man anywhere here. We named this Beaver Meadow Pond and by rapid barometrical measurement, find it to be 2,193 feet above tide. *It is apparently the highest pond source of the Oswegatchie River now for the first time made known.* After a short march *Otter Pond* was reached. Its height was taken by barometer and is computed at 1,959 feet above the level of tide water. It was late when we reached *Silver Lake* and launched our boat in its clear water; and we immediately commenced a survey of the shores. Such angular measurements as time permitted were made with the azimuth compass, and a satisfactory reconnaissance map of the lake with the neighboring mountains was secured. This took so long that the barometrical leveling had to be deferred until another

time; and hoping to return in a day or two to complete our map and measure "Long Tom Mountain," which rises on the shore of the lake, we left the boat in the woods near the lake, and made our way wearily back to camp. It was the evening of the second day since the guide had been despatched for provisions, but there was no sign of his return. If our cartridges had not been used in firing signals, we might have killed a deer; for we had seen several that day; as it was we took each his mouthful of bread — unleavened and saltless — and wrapping our blankets round us, went to sleep. The silence of the deep primeval forest that night seemed greater; it felt more empty and more desolate, as we were brought to consider how little sustenance for man those gloomy evergreen woodlands afforded.

Oct. 24. We had food for reflection, but little else. Sent the remaining guide to Bog River to see if he could find any thing of the other man. The day clearing off, concluded to endeavor to finish the work on Graves' Mountain. Set out accordingly with my assistant, but feeling faint climbed slowly and wearily. On the summit we found the theodolite in its rock house. Resumed the work, and at dinner time, having nothing to eat — took a short rest instead. The afternoon was wearing on, the lakes below were silent — what had become of the men? The distant report of a rifle toward the Chain Lakes of Bog River seemed an answer — one, two, three quick shots told of a repeating rifle and supplies. It was night before we were rejoined by the guides, and the theodolite was boxed and packed by one man down the mountain, in the dark to our camp, where venison they had killed that day, and fresh provision enabled us to break our fast.

Oct. 26. In light marching order, leaving our baggage under cover of the ponchos — set out through the woods to Great Cranberry Lake, the guides carrying the boat. Examined Little Gull Pond and Darnneedle Pond. These slender sheets of water had been known to me for some years past, but do not appear to have ever been placed upon a map. Leaving them we marched the same day to Cranberry Lake, and embarking on that broad water, descended to the outlet where we found shelter. From the islands in the lake we could see Graves' Mountain and the long ridge far away at Silver Lake, which is known as Long Tom Mountain. The summit of the latter was evidently the best station from which to cross the lines of sight extending from Graves' Mountain to islands of this lake, and I decided, on our return, to occupy it for triangulation.

On the morning of Oct. 27th, a long and continuous series of barometrical observations were taken, for the purpose of determining the height of this great woodland lake, above the sea. From the mean of seventy-seven observations directly compared with the records of the recording instruments at the Dudley Observatory, the height of Cranberry Lake above tide is computed at 1,540 feet; being the first determination of its altitude. This station being so far west of our meteorological meridian, the records of the Dudley Observatory were compared with those of the U. S. Signal Service at Oswego, N. Y., etc., furnished me by the War Department — and the comparison indicates so favorable a condition of the atmosphere, that I feel sure our measurements will be within the limits in such measurement as defined by Humbolt.

Maintaining our station at the shore of Cranberry Lake, I proceeded

personally to Grasse River — a point where it is fordable. This I found to be 88 feet lower than Cranberry Lake, or 1,452 feet above tide level.

Cranberry Lake.................	1,540$\frac{23}{100}$ feet above tide.
Grasse River Ford..............	1,452$\frac{54}{100}$ " " "

The 28th was stormy and we remained at the lake, gathering much important information from hunters and fur trappers, of new lakes, etc., in their special localities. During the night there was a flurry of snow, and at morning it was piercingly cold. The return was ordered, and after a dangerous sail over the lake — rolling in heavy foam-crested billows — we disembarked from our overladen boat, the men again shouldering it, and by a rapid march we reached at night our camp at Graves' Pond. The elevations of Little Gull Pond taken to-day by barometer is, computed by a direct comparison with synchronous readings at the Dudley Observatory, 1,907 feet. We found our poncho-tent camp incrusted with ice, but building up a fire thawed and warmed the place. The night proved very cold.

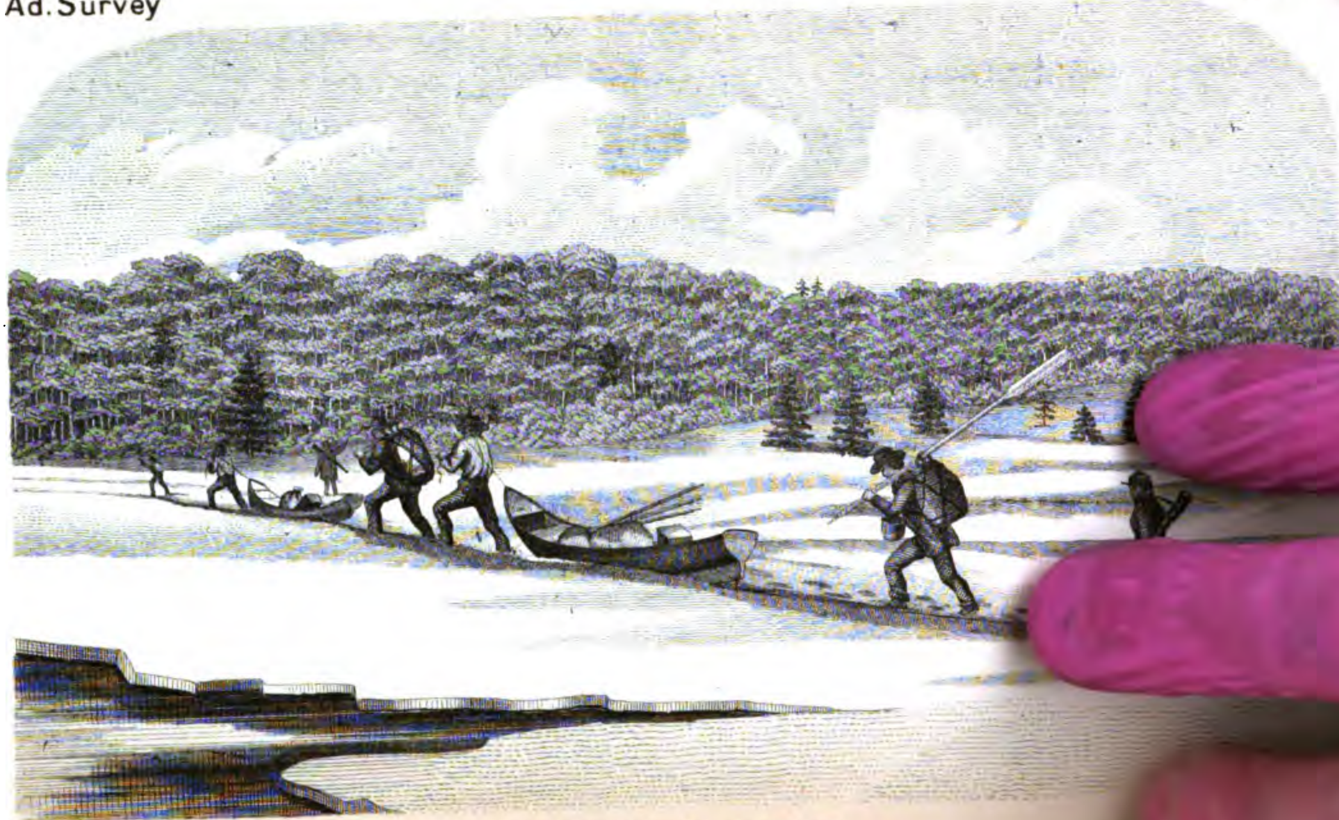
Oct. 30. The *minimum thermometer* recorded the lowest temperature of the night at 24° 5′ Fah., or 7° 5′ below freezing point. We were startled, on descending to the shore of Graves' Pond to find it partially frozen — a sheet of ice extending 12 feet from the shore. It was advisable that the final explorations should be entered upon at once, for should the streams become frozen and provisions fail us, the situation might become disagreeable. Directing one guide to transport his boat and the baggage to Bog River, I set out with the other guide and assistant for Silver Lake, to finish the work in that neighborhood. Finding the boat left there, we went by water to the upper end of the lake, and stationing the assistant with his barometer at the shore, I set out with one man to climb Long Tom Mountain. In the snow, the tracks of bears and other wild creatures were abundant. We made a detour, and ascending to the summit, commenced work. It was bitterly cold, and eastward, between us and the frosty peaks of Essex county, we could see lakes already partially frozen over. With Mt. Santanoni and Blue Mountain (signal) as zero, angular measurements were made. Angular measurement, and magnetic bearings of different points in Cranberry Lake were taken — the guide chopping away trees interfering with sight. The thermometer stood at 29° Fah., and the snow thawing and freezing on our boots as we stood at our work, and the cold, cutting wind also chilling us, made, what would have been a pleasant scientific labor, a painful duty. My barometrical observations on the summit directly compared with those of the assistant on the lake shore below, show Long Tom Mountain to be 620 feet higher than the lake, which, by our measurement is 1,983$\frac{32}{100}$ feet in altitude. The total height of the mountain above tide is computed at 2,604$\frac{28}{100}$ feet, this being the first measurements of these heights ever made. Descending, we reached the shore of Silver Lake about 3.30 P. M., and swiftly passing by boat to the other end, we set out for Bog River — the guide carrying the boat — and after a very rapid and fatiguing march, reached the camp prepared by the other guide on the shores of the river. As the night was very clear and the stars distinctly visible, I determined to make astronomical observations in order to find the magnetic declination (variation of compass from true meridian,) and also the latitude. Taking boat

we set out in search of a suitable station, near lake or river shore. Finding a place whence the more important circumpolar stars were visible, we landed with transit and sextant, and arranging the instruments, awaited the culmination of *Polaris*, which would occur after 10 P. M. The magnetic declination was found to be 9° 6′ 35″ west of true north. From the altitudes of Polaris taken, I have computed this station to be in North Lat. 44° 5′ 15·″26.

Oct. 31. The minimum temperature last night was 29° Fah. The barometer has fallen 2-10ths since last night. This morning an exploration southward afforded us one new lake and a little spring-pond, the shores of which were fairly stamped and cut up by the hoofs of deer. A guide, sent some miles back to search a valley, where we thought there might be another pond, returned in the afternoon without having found any thing. About mid-day, the wolf-trapper of the "Lost Lake" country, whom I had engaged to meet me, floated to our camp in his dug-out or log canoe. The time fixed for our entrance on the exploration of that most wild and remote region west of Mud Lake was near, and it was gratifying to consider our success in the work set apart for the appointed interval, and the promptness of the trapper in meeting us at the appointed time. Sending him in advance to his deer-pond, or the Lost Lake, we loaded all our baggage, instruments, etc., into the boats, and moving up Bog River camped again at Mud Lake with the men whom we had before found there deer-killing. They had been quite successful, having killed some sixty or seventy large deer in the short period of their stay, and sent them out by boat. The presence of these men was of great value, for I was able to hire the whole party to aid us in transporting our boats and baggage into the wilderness westward on the morrow. During the night we had more snow. The minimum temperature was 26° Fah.

November 1, found Mud Lake still open, though the upper portion was partially frozen over. Embarking we passed up the lake and now reached the end of navigation. Drawing the boats out on the ice margin we turned our backs upon even the remote and desert shores of Mud Lake — lonely doleful water — and with winter closing in around us, loaded with baggage and drawing our boats with ropes over the yielding snow, we started directly westward into an unknown region of dismal wilderness, with whose dangers or obstacles we were unacquainted; a small sack of flour forming our principal reliance. The desolate snows of the barren marshes — the drear, wintry aspect of every thing — gave the scene the appearance of an arctic exploration. Judging that they would only be able to march and draw their boats as far as the Lost Lake that day, having to chop and clear a trail or passage, as they advanced and blaze the trees; I ordered them to encamp at that lake; and, despite the heavy snow-storm, taking with me one guide, I struck away southward and made a march to Bog Lake — first stationing the assistant with barometer on the shore of Mud Lake. We secured synchronous observations, from which I have computed the height of Bog Lake — beautiful lake, worthy of a more appropriate name — at ten feet above the well-named Mud Lake. Its height above tide level is $1,755\frac{48}{100}$ feet. Certain necessary angular measurements were also made. I took the trail of the guides and found a boat left for me at the shore of the Lost Lake, by which I reached their camp.

But there is not space to detail all the labors that ensued.



Drawn by Verplanck Colvin

MUD LAKE.

Winter march westward into the unexplored region.

On November 2d, stationing the assistant on shore of Lost Lake, I recommenced the work of exploration, and proceeded over the snow-clad hills with one of the wolf-trappers, first to *Tamarack Pond*, and afterward to *Cow-horn Pond*, named from its singular shape. These ponds are both unknown to the maps; and though near to each other, the one flows to Mud Lake and the other to the Oswegatchie River.

By my measurement, I found *Tamarack Pond* to be much lower, and Cow-horn Pond 11 feet higher than Lost Lake. The mean height of Lost Lake — directly compared with mean height of Mud Lake by synchronous observations, is $1{,}761\frac{33}{100}$ feet above tide:

Mud Lake, mean	height.....	$1{,}745\frac{33}{100}$	feet	above tide.
Lost Lake,	"	$1{,}761\frac{33}{100}$	"	"
Tamarack Pond	" (?)	1,746—	"	"
Cow-horn Pond	"	$1{,}772\frac{38}{100}$	"	"
Crystal Lake	"	$1{,}663\frac{45}{100}$	"	"

The measurement, elsewhere given, of Crystal Lake, was founded upon a few careful observations unconnected with the Lost Lake base.

The guides were exhausted with labor and looked anxiously for some relief. In our previous march back into this portion of the woods — ten days before — we had been surprised by the comparatively level character of the country, through which we had to travel, without sight of mountain landmarks for our guidance. The forest was here, open hardwood, and we conceived an idea that it might be traversable for horses. On questioning the wolf-trapper, we learned that saddles of venison *had* been carried from near this point by horses brought in from the distant settlements. This hint was sufficient. A guide was despatched out to the settlements of St. Lawrence county for animals. Suffice it to say that they arrived, and that there — but two miles from the desolate and remote Mud Lake, we loaded our boats and baggage on a rickety sled of poles, and, the axe men cutting a way through the forest, chopping away the fallen trees, now, all together, aiding on some steep hill side, and again struggling to prevent an upset on a precipitous decent, we drove — or carried — our way to the navigable waters of the Oswegatchie River. As this is the first record of direct exploration and boat carrying, westward from Mud Lake to the unknown Oswegatchie headwaters, it may be interesting to those who have penetrated near the sources of Bog River or adjacent lakes. In pushing against ice in the lakes and in effecting this desperate "carry" (Adirondack phrase) the boats had suffered. One had a hole punched in its side, and both were so leaky and unseaworthy that we could proceed no further without repairs. Our provisions were again failing us, and having effectually severed our connection with the Essex county base of supplies, we sent out into the St. Lawrence county settlements for food, and for material for repair of boats. While awaiting these supplies, we were able to accomplish some valuable work.

November 3d was stormy, with sleet and snow. I was able, nevertheless, to make a search for the St. Lawrence county line, and found it, or at least what remained of it. This county line, which appears only to have been run with magnetic compass, seems merely to have been marked by blazes upon trees; no cairns, marked stones, or other

permanent witness being found. The trees had long since reached their age, were now crumbling with decay and falling to the earth, many having disappeared. It was clear, that unless some other permanent line should be run to replace this, in a short period the lines of division between St. Lawrence, Herkimer, and Hamilton counties would be untraceable save by resurvey. Such a result is to be deplored, for from such negligence occur many of the disputes as to *gores* of land claimed to exist while the question of proper description of lands in tax sales might make the location of the lines a matter of importance. In examining this matter, I ran with compass some distance east and west along this line, and found the corner of Herkimer county, after some difficulty, making a considerable detour in order to find that line. It was also in a crumbling condition.

November 4th. It was clear but cold. The minimum thermometer, when examined this morning, was found to record 19.°5 Fah., or twelve and a half degrees below zero centigrade. The barometer had fallen 0′,150 in. since yesterday, and our affairs began to look gloomy. With this continuance of such a temperature the lakes could not fail to freeze, and while the snow was not yet deep enough to seriously incommode us or interfere with exploration, yet a slight increase in its depth would much increase the labor of marching under heavy knapsacks. This was the day of the State election, and while far away in the settlements men were engaged in the excitements of the political struggle we found ample occupation for our time in surveying and marching, through the wild forest. Reached and ascended a summit known to the trappers as Poplar Mountain, which commanded a view of the valleys we were now traversing, and of the high peaks of Essex county which, in the distance at the east — a ragged snow-white sierra — could be recognized by us, peak by peak, as the savage crags, amid which we had climbed, and labored during the early summer and autumn. With some of these peaks — and other distant stations, as zeros in tri-linear work, angular measurements to the prominent neighboring mountains were made, and such observations taken as would enable us to locate Poplar Mountain trigonometrically by three point problem.

November 5th opened cloudily, but cleared off and we proceeded to the *Five Ponds*,— another collection of lakelets unknown to the maps. A hypsometrical measurement was made for water level of *White Pond*, from which its height above tide is computed at 1,687 feet. The supplies from the settlements arrived to-night.

November 6th. To-day we struck out southward, determined to push forward — come what might — to the Beaver River settlements, giving our attention to the leveling and topographical reconnaissance as we advanced. Another fierce struggle through a more rugged region than on our last march, ensued. Felling trees, clearing away fallen timber, fording rivers, corduroying hollows, and semi-bridging difficult streams, we advanced, and at nightfall reached, and camped near the shore of a lake to which the trappers had conducted us. It was called by them Gull Lake, — but was entirely unknown to the maps — and launching a boat we hastened to examine it. We were truly astonished. It was a large lake with winding shores, deep bays and jutting points, inclosed by mountain ridges richly dark, with evergreen forest. Its clear deep water reflected like a mirror the forest shores; and the

Drawn by Verplanck Colvin

Lith by Weed, Parsons & Co.

ST. LAWRENCE CO. LINE

Decaying condition of marked trees.

brilliant sunset sky and floating clouds gleamed below with scarcely less splendor than above. The lake appeared over a mile long, and was thought to have an area of four or five hundred acres. The discovery for our map of such a body of water—having an area of from three-quarters to one square mile—in a place where all the maps show good solid ground, was a valuable result of this survey, for lakes in this region are the roads and highways, the avenues for travel for trapper or hunter or lumbermen.

November 7. We were up before 4 A. M., and had breakfast. The minimum temperature of the night was 21° Fah. The morning was spent upon the lake, and a reconnaissance map secured. In the afternoon two of the guides were directed to kill a deer for the camp. Leaving them at the lake, I went with one guide and the assistant to the top of a mountain some miles distant, which afforded a good prospect of the surrounding country. It was, however, timber-covered, and in order to obtain a sufficiently unobstructed view, I strapped upon my own feet the climbing-irons and ascended to the top of a large and lofty spruce tree. The tree was so moved by the wind that even the sextant could not be used for measurement, but valuable topographical notes were made; for from this lofty perch I looked down upon the secret topography of the wild region lying north-westward of the Smith's and Albany lakes of Beaver River. Far eastward the white cones of the greater Adirondack peaks were seen, and nearer the gray rock front of Graves' Mountain, with our automatic signal beaming and glittering where we had placed it. This mountain had no name; but, a large deer, pursued by one of our hunter's dogs, coming unconsciously to a stand near the foot of my tree, we named it Deer Mountain. Not being prepared we did not get the deer, but found, on our return to camp, that the other guides had killed a fine doe, which was sufficient for our purposes.

November 8th was stormy. Barometer has settled ·330 in. lower, standing 27·300 at 9:30 A. M. The height of Gull Lake, as computed, is 2,018 feet above tide. The prismatic compass was used in the lake work, the station at the east end being rendered visible from the other extremity of the lake by a small stan-helio signal (4th order) placed there. Even this large lake began to show the effects of the severe weather. The shores were margined with clear hard ice, and before we could proceed on our journey we had to break a course out into the open water, and the thin shell-like boats had soon fresh rents and leaks. It was plain that before long the occasional easy transit by water, which so rested the men, would have to be abandoned for steady marching under packs. Other lakes were found frozen entirely over, and we now concluded to leave there, in the woods, the boat which was the most injured, and carry only one for use in crossing the lakes and rivers that might remain unfrozen. Some of the men carrying the packs, and one the boat, we commenced our march; all of us laboring under the weight of luggage, the surveying instruments and the heavy camp equipage, great packs of army blankets, etc., rendered necessary by the severity of winter. Reaching Oven Lake—another large new lake not on maps—we took a few barometrical observations from which the altitude is computed at 2,025 feet above tide. This lake was nearly frozen to the center, but after ferrying us across—we having first to cut a way through the ice—two of the guides concluded that they

would rather break their way with boat through the ice the length of the lake, than to carry the baggage and boat through the dense, tangled forest, full of fallen timber and thickets: feeling confident of their ability to do this, they were permitted to proceed.

For a time they distanced us; for while we had crept slowly along the shore, they had advanced nearly to the center of the lake. Here it was their misfortune to strike thick ice, and crush a large opening in the boat below water line. Attracted by their shouts we descended to the shore to see men, stores, every thing in danger of loss. Unable to assist them we could only shout encouragements. By quickly shifting the baggage to the stern, they brought the gash above water; but the inclosing ice would not yield, and in getting out and in endeavoring to draw the boat upon it, we saw with agitation first one and then the other break through into the icy water. They at length, after danger and labor wearying to describe, effected a landing; and though shivering, wet, icy, and weary, were ready to resume the march. Abandoning this boat also, we struck out under the guidance of the trapper for a point which we thought would be our last station on the Oswegatchie waters. Through tangled woods we groped on until night, when lighting a lantern, the trapper led us on by marks and signs — a long night march — to a camp. The surrounding region was peculiar, forming an elevated divide between the sources of the Beaver River and other streams. Upon this elevated land were many new lakes unknown to the maps, beside the Gull and Oven Lake, among which *Partlow Lake* — now entirely frozen over — was prominent. I regret that lack of time prevented our effecting its measurement. This section is desolate, and the trapper assured us that packs of wolves made it their habitation.

November 9th found us on the shores of Crooked Lake. Silent and solitary water of the wilderness — of deep bays and winding shores — the dark fir trees, silvery with snow and frost, margining the icy lake. It being navigable, the guides made a hard march and brought up the boat from where we had left it. Camped this night in an open wigwam — cold and desolate.

November 10. Another fall of snow during the night: the ice on the lake increasing. Having plugged up holes in the boat, and patched the cuts we made a reconnaissance of the lake with prismatic compass from points reached by boat, and obtained an excellent and accurate map of its form. It was a singular body of water, and abounded with speckled trout. Our barometrical leveling indicates for Crooked Lake a height of 2,022 feet above tide. In the afternoon we made another advance southward — cutting our way through the ice, or dragging our boat over solid portions — to spring into it again as it broke through ice. Leaving the lake and carrying the boat and baggage over the divide — stumbling with our loads over the trunks of trees — slippery with deep snow, we passed the intervening pond by boat; and after another carry, unslung our knapsacks on the steep bluff shores of Clear Lake, whose deep, greenish waters were as yet entirely unfrozen. We passed the boat down the bluff and launched it on the lake. Solemn and desolate was the scene. The clouds that had overshadowed us so long, hung threateningly down, and hid all but the lower slopes of the snow clad mountains from sight; and gathering gloom with the approach of night grew each moment deeper, darker and more frown-

Drawn by Verplanck Colvin. Weed, Parsons & Co. Lith.

OVEN LAKE.

Accident to the second boat - The Guides baggage and instruments in danger

ing. The shores of the deep lake fringed with leafless bushes were horribly grim, with a dead forest of once majestic spruce trees; now leafless, colorless; victims of that strange timber mortality which I observed last year in the Cedar River country. Here this forest, as though killed by a curse, stood dead; and the winter winds swept through a waste of crumbling limbs, where all was once beautifully and richly evergreen We had left behind us the last trickling rill of the Oswegatchie head-waters, had crossed the water divide, and encamped near the uppermost of the lakes — whimsically called by the hunters and trappers of Beaver River, the Red-Horse Chain. Here our trapper was off his hunting grounds, and we had to rely on our own resources. It was cold and there was more snow, but we passed a comfortable night.

The morning of the 11th we found the snow to be over one foot deep. The minimum thermometer had been broken, and was hereafter worthless. The barometer however showed an increasing pressure, having risen $\frac{28}{1000}$ during the night. Our next immediate labor, after finishing here, was the descent to Beaver River, which was now the more imperative as provisions were again failing. In planning this expedition before entering the woods, two months previously, I had marked this as part of my route, and had made careful inquiry, and learned of the intention of a Beaver River trapper to pass the winter at Salmon Lake, further down the chain. I now gave the two Saranac guides directions to make search at that lake for the man, and they set out southward carrying the boat and one load of baggage. Guided by the trapper I started for Niger Lake — modification of a name long previously given by the trappers on account of its dark waters — leaving the assistant stationed at Clear Lake with barometer. Climbing over ranges of hills and mountains we ascended a mountain to the north of the lake, and had a glimpse of the region — soon obscured by a snow storm. It was bitterly cold, and we hastily descended to the lake and entered on the work. From my barometrical observations, synchronous with those at Clear Lake, I have computed the height of Clear Lake above Niger Lake at 163 feet. Our measurement of the total height of these lakes is as follows:

Clear Lake, above tide	$2,005\frac{23}{100}$	feet.
Niger Lake, above tide	$1,842\frac{16}{100}$	"

Heavy clouds, gloomily obscured the sky; the black forest on the inclosing mountain sides, was savage and grizzly with frost; and before us spread the inky lake, whose sullen waves would soon — despite its deepness — be turned to ice. It was bitterly cold, and we were in danger of freezing. A reconnaissance map sketch of the lake was, however, executed with the aid of the prismatic compass, and we hurried on our return. Darkness threatened to overtake us, and the constantly falling snow had nearly buried our tracks. Having left even overcoats at camp, in order to make a rapid march, the prospect of a night in the desolate forest was not agreeable, especially as we had no food. By vigilance and activity we reached exactly the same point on Clear Lake, which we had left at morning, and found the guides returned from Salmon Lake, having succeeded in finding the Beaver River trapper, and had brought him with them.

November 12. I paid off the Oswegatchie trapper, who, shouldering his rifle, struck away northward on his return to his trapping ground — back into the remote wilds — with easy confidence in his ability to furnish himself with food from the forest game.

The new trapper assured us that Beaver River was still unfrozen, and that he had a boat which would enable us all to descend the stream to the Stillwater settlement. Each carrying his knapsack we marched to the end of the long portage, and, embarking, descended the inlet of Salmon Lake. We were compelled to break one-quarter of a mile of ice to enter the open water, and it was mid-afternoon before we were ready to depart. A reconnaissance map of the lake and surrounding mountains was executed with the aid of the prismatic compass. A small tin cone signal marks the south-eastern corner station. From our hypsometrical work here, I have computed Salmon Lake to be 1,756 feet above tide. Carrying boat and baggage we marched immediately southward to Burnt Lake, where we again launched our boat and passed down to a trail or carry.

A good form of Burnt Lake was secured with the prismatic compass — readily used from the boat saving much valuable time. Again shouldering boat and knapsacks — the heavy transit in its box, being of itself a considerable load — we moved rapidly across the carry, and at dark stood on the banks of Beaver River, having successfully crossed the region which I had proposed to map, through all obstacles, and reached the very spot on which I had intended to debouch. We were now upon the ground visited last season (1872). The new guide — trapper — brought his boat; the oars dipped the water, and we swept down the dark and handsome river by night. The long snow storm which had now been upon us for many days shortly commenced with violence again, and, bewildered, we groped on our way down the river, and late at night reached the familiar mouth of Twitchell Creek. Here, to our discomfort, we found all frozen, yet with ice too weak to hold us while crossing to the shore. The new guide feeling sure that Wardwell or Round Pond would be open, we passed down to it only to run suddenly, in the dark, upon the ice-sheet; the whirling snow hiding forest or shore from sight. Efforts to land seemed futile. Penetrated by the cold, we resolved not to pass the night in the boats, and in struggling to effect a landing, these were cut by the ice and quickly the water rose above our feet. The water freezing in the leaks apparently saved us; and after struggles and difficulties — the shivering of oars and paddles by the ice — we cut a passage through to the shore; and, though exhausted, made our way to the first tenanted log house on this side of the woods. Here we found only one person, an old hunter, who was somewhat bewildered at our arrival; the settlers on this side having concluded that we would not be able to get through to them during the winter. All the other occupants had gone out to the true settlements, and had taken with them their supplies, save sufficient for the trapper, though there was an unlimited amount of maple sugar. Before the fire we thawed the sheeted ice from our clothing, and soon found much needed rest in sleep.

The Beaver River Lake region is comparatively level, and there being no commanding or bald mountains from which views of the numerous lakes could be had and angular measurements to them made, I had here designed taking some approximate or explorative measurements of

Drawn by Verplanck Colvin.

Lith by Weed, Parsons & Co

ROCKET SIGNAL

New method of approximately determining the location of new lakes in the woods.

the position of unlocated waters, with the aid of signal tripod rockets observed on simultaneously with two transit instruments from the extremities of a large base. The chest of rockets sent into this station, by way of Lewis county, in July, was at hand, and I determined to make a trial of the method.

November 13. The guides report that the last battle with the ice has rendered our second boat altogether unserviceable. The heavy ice had broken or cut holes in the sides which had, fortunately for us, been closed with ice. The boat was therefore turned up side down and abandoned to the long dreary winter. Sending two men, in the trapper's boat, back up the river to proceed with rockets to signal stations at Burnt Lake and Salmon Lake, and one man to the next western settlement (No. 4), about 11 miles distant, with directions for rocket signaling at appointed intervals in the evening, we devoted our time to writing up notes, and work on reconnaissance maps. We watched the clouds at evening with interest, and as they had risen to a considerable height and no longer hung down covering the mountain tops, we had strong hope that the rocket work would be executed successfully. As it grew dark we set up and leveled the theodolite; clearing a place in the snow for our rocket work; and, adjusting the instrument, awaited by lantern light, the appearance of the rockets. At 8 P. M. a rocket was seen to ascend from Burnt Lake, but immediately afterward it commenced to snow again, and we were compelled to put up the instrument — the storm hiding every thing from view.

The applicability of this method of rocket reconnaissance to the preliminary exploration for the position of lakes in a level country was now proved. Winter, however, was no time for this work, which would require, on the part of those at the lakes, the rudest sort of outdoor wilderness life. Its further application was therefore postponed till summer.

The man sent to No. 4 returned at night with five pounds of coarse flour; all the provisions he could procure.

November 14. While awaiting the return of the guides, a careful hypsometrical measurement of the stillwater level above tide was made; and the computation based upon over seventy readings of the different instruments, and compared with the Dudley Observatory, and Oswego and Burlington, affords as height of Stillwater 1,656 feet above tide level. It was very cold, the thermometer at one time descending to 16° Fah. This work was continued until 2 P. M. when the guides returning by land, signaled by rifle shots for a boat to bring them across the stream. The storm last night had increased the depth of the snow; and the guides endeavored to dissuade me from further work, and urged a retreat to the settlements of Lewis county, and to Lowville, whence we might reach Lake Champlain again by rail. On questioning our hunter host, I found that the ice in the mud holes rendered the way out impassable to horses; that it would take at least a day to go after them, and that he felt sure no horse would at any rate, be risked for such work, till every thing was frozen solid; when in all probability the snow would be waist deep, and then a roadway would have to be dug through it for 12 or 13 miles at least. After a short calculation of the number of days required to proceed to our station at Long Lake, Hamilton county (which was our destination), by the long detour via Lowville, I concluded *not* to change the route of march originally

selected, but to proceed and execute the work I had laid out, even if it became necessary to march through the deep snow the whole width across the wilderness to Long Lake. Our provisions were again at the lowest ebb; and though there were plenty of deer in the woods, there was so much fallen timber, that it was impossible for the guides to get near enough for a shot without alarming them.

November 15. Three guides with packs (one load being the transit) set out on a preliminary march to a point four miles eastward, where they left the baggage, and procured some provision from stock laid in by our Red-Horse Chain trapper-guide, for his own use in the winter. They descended the river by boat, and stated that some of the ice had broken away, and that it might be possible to move the baggage by boat to the little rapids. The snow was getting so deep and was so steadily falling and increasing, that it was deemed unsafe to start back into the woods without at least one pair of snow-shoes, to enable us to send one out for help in case we should be snow bound. Our hunter-host, therefore, busied himself with the construction of the snow-shoe bows, while the pack-carriers were directed to keep a lookout for venison, as we should need a deer skin for the snow-shoe stringing. A sled was also contemplated, but it was found impossible to draw any thing through the loose deep snow. The packmen returned at night without deer or deer skin. The weather is too severe to execute any topographical work, and we must devote our energies to crossing the wilderness and getting out of it.

On the morning of November 16, we commenced the march eastward across the desolate winterbound wilderness. Two of the men proceeded with the rest of the baggage by boat, while accompanied by one guide and the assistant, I set out on foot. We carried the two large barometers carefully in their leathern cases. The snow was above our knees, and the walking tiresome. About two miles from Twitchell Creek we came upon the track of a large panther or cougar, and as from the crookedness of the river we should be far in advance of the boat party, and have time to spare, we resolved to chase and endeavor to destroy this monster. Taking the trail we at length drove him from his bed and pursued him on the run for a mile or two, when he struck away southward, leading us so far from our course that we were compelled, though reluctantly, to abandon him. We saw, also, the tracks of two other large panthers, and of a large bear during the day. Resuming our march, we reached the rapids, where we met another trapper, and engaged him to assist us. The boat party did not get in till after dark, by lantern light.

November 17. This was the second day of our march. Albany and Smith's Lakes were frozen; we shouldered our knapsacks; again bid farewell to boats, and pushed on into the woods. Crossing Thayer Pond on the ice, which cracked beneath us as we marched, we toiled on through the deep snow all day, and about dark reached Beach's Lake, where we remained that night. This deep lake was found open and I determined to remain one day and take its altitude.

November 18. The two Beaver River trappers were paid off, and returned. The other guides were directed to carry two loads of baggage forward to Raquette Lake and to return to us the same night. It was bitterly cold, the temperature being as low as twelve degrees below the freezing point Fah. The atmospheric pressure was decreas-

ing, the hourly fall of column being ·046. The first computation of this measurement gave us much surprise. Our observations, when subsequently compared with the synchronous data of the Dudley Observatory, would have indicated that this lake had a very remarkable elevation. This was so much in excess of what I had anticipated that a long and careful scrutiny of all the data has been made. As hereafter more especially described under the head of Hypsometry, the height was, on March 30, 1874, finally computed by the exactly synchronous data of the United States signal service stations at Oswego, N. Y., and Burlington, Vt.; from which I obtain 1,877 feet as the mean altitude of Beach's Lake above tide level. It has never been previously measured, and I hope, before the publication of the map, to be able to again measure it, having observations taken at the same time at Raquette Lake as a near lower station. The guides dispatched to Raquette did not return till late, having found the snow much deeper and the march laborious.

November 19. We bade adieu to Beach's Lake, and shouldering the remainder of the baggage, marched to Raquette Lake. Noticed the tracks of a very large bear in the snow. Though the signs of deer were abundant, we were unable to secure one for food, and the marching through snow over our knees, had become so exhausting as, with the failure of provisions, to make matters look serious again. Finding some flour in the building — now vacant — near the outlet of Raquette, we were reassured.

November 20 was devoted to barometrical leveling on Raquette Lake. The barometer was set upon the frozen surface of the lake and continuous observations taken. From the mean of these observations, directly compared with the synchronous observations recorded at the Dudley Observatory, I have computed the height of Raquette Lake at 1,765$\frac{20}{100}$ feet above tide level. By a computation based on the United States signal service observations — entirely independent of the other — simultaneously taken at Oswego on Lake Ontario, and at Burlington, on Lake Champlain, and reduced to sea level, I find the height to be 1,767$\frac{22}{100}$. This last determination is based on a single observation of the thirty-five which we took at Raquette Lake; a single reading exactly corresponding with single readings taken at Burlington and Oswego.

It is interesting to find work based upon such distant stations so nearly agreeing. Had there not been the greatest accuracy in observation at Burlington, Oswego and the Dudley Observatory, the results would have been very different.

During the day I made a reconnaissance of the shore of the Lake, hoping to find the ice midway sufficiently strong for the measurement of a base line. It cracked and snapped, however, under my feet at every point where I attempted to cross and it was evidently unsafe to undertake the work. It had ceased to snow, and the prospect opening beyond a beautiful winter scene was disclosed. The broad lake stretched away southward in one wide ice sheet, white, desert and silent, yet broken picturesquely by dark headlands and points — swarthy with dense evergreen forest. Far beyond, ranges of mountains extended, frosty and still — dimly azure tinged; no smoke from hut or house was visible — no creature seen; not even a bird in air. The howl of a wolf would have lessened the solitude.

While we were busy at Raquette Lake, the guides, in accordance with my orders, had set out in different directions, one going back several miles to bring up the theodolite (which we had been obliged to leave behind in the snow, covered with rubber ponchos), and the other setting out down the rude wilderness road to Long Lake, now only a day's march distant, for assistance, and a team and sled, if procurable at the settlements. The snow here was not so dense as it had been further west, and being only from twenty inches to two feet in depth, we thought it possible that a team might be brought in for the baggage. The man who was sent back, westward, on our trail, for the theodolite pack returned in the afternoon.

November 21. I left a guide alone at Raquette Lake, in charge of the baggage; and with assistant — each carrying a barometer — set out on the march for Long Lake, determined if a team could not get through, to send in fresh guides or packmen to carry out the baggage.

On our march, about 1 P. M., we had the pleasure of meeting the first team that we had seen for nearly two months. It was the relief, struggling in to our assistance. The strong, powerful horses dragged the sled *through* the snow, ploughing it to right and left, and made the walking better after it had passed. The march was, nevertheless, extremely exhausting; we had no lunch, and, with our utmost efforts, it was dark when we reached Long Lake. Here we found the advance guide awaiting us, with preparations for our coming, made; and, comforted by warmth and plenty, we could think with satisfaction of our successful labors, and the completion of this arduous march across the wilderness in winter.

It was near night on the 22d when the team with the baggage, and the last man, reached us. Meanwhile we had ascertained that Long Lake, like other lakes, was so frozen over as to be impassable to boats; yet the ice, covered deeply and protected by the snow, was not strong enough to hold a man. Our most important material, field books used in the previous expeditions, etc., were in the trunks at Bartlett's, inclosed by the frozen lakes, and in order to reach them, and to return the guides to the starting point, I resolved to take team and drive out to the true settlements; thence northward to Elizabethtown, and then westward again over the Keene Mountain to Martin's, on the Lower Saranac.

November 23d. The sleighing was good, the drawing of timber by lumbermen on some parts of the road making it excellent, and we were upon the way before sunrise. By steady driving we reached North Hudson the same night, a few hours after dark. During the night more snow fell, and the morning of the 24th showed that the storm still continued. We were again early upon the road, but the snow was so deep that the sleigh ploughed its path through an apparently unbroken way. We, however, reached Elizabethtown early in the evening.

November 25th found us on our way to the Saranac Lake, and after a long and tedious drive over the Keene Mountains and North Elba we reached Harrietstown, and at 8 P. M. Martin's, from which, fifty days before, we had set out in our boats for the labors of the Third Division. We had made a circuit of the wildest portion of the woods; we had executed the work nearly as anticipated; and our general course of exploration, as originally planned, had been rigidly and successfully adhered to. That we were all there together again, without the loss

of a life, after the many precarious positions the early and severe winter had brought upon us; that some one of us was not now lying shrouded in ice near the good boats we had left in the remote, desolate forest, was a cause for rendering thanks to the All Seeing Providence that had protected us.

November 26. The Saranac Lakes were in the same unfortunate condition as those that had occasioned the misfortune to our boats in the Beaver River country; they were not open, and notwithstanding a temperature of two degrees below zero Fah. (34° below zero, centigrade), the deep snow upon the ice prevented the water from freezing. The assistant and guides were sent down the eastern side of the lake to proceed to Bartlett's and bring out the trunk, or at least the field books and records.

November 27th I devoted to the barometrical measurement of the altitude of the Lower Saranac Lake. The observations were continued from 9 A. M. to 5 P.M. At sunrise the temperature stood at a little below zero Fah., and at midday the temperature of the air was only + 10°5, Fah., while at sundown it soon fell below zero again. After long and tedious computations in which the synchronous observations at Burlington, Oswego, and the Dudley Observatory were in turn used as data for lower station — first separately and then together at different hours — I have found the mean height of the lower Saranac Lake, at Martin's, to be $1,524\frac{60}{100}$ feet above tide level.

Lower Saranac Lake............	$1,556\frac{62}{100}$	feet	above	tide.
Round Lake....................	$1,576\frac{15}{}$	"	"	"
Upper Saranac Lake............	$1,605\frac{22}{100}$	"	"	"

These are separate, unconnected results, the exact difference of level between these lakes being yet undetermined.

About dark, on the evening of the 27th, the assistant and guides came in from Bartlett's, exhausted and almost frozen, their clothing and beards covered with ice. They had been able to bring only a portion of the baggage, drawing one trunk on a hand sled by long ropes across Round Lake — the ice cracking beneath them and the sled sometimes cutting through. The river between the lakes was open, and they put sled and baggage into a boat brought up for the purpose, but were compelled to take to the ice again on the Lower Saranac, which, however, was found very thin and hazardous. The feet of the assistant were slightly frost bitten. Paying off the guides who had been with us so long, we were busy till after midnight in packing and boxing the baggage, instruments and camp equipage, proposing to set out for Lake Champlain on the morrow.

On November 28 we left the Saranacs, and the sleighing being good, reached Elizabethtown, Essex county, the same night, whence we proceeded on the 29th by sleigh to Port Henry.

When, nearly two months before, I had set out upon the work of the third division, I had determined, last of all, to return to this place and finish the measurements of Crown Point, which for lack of U. S Coast Survey data we were unable to finish in July. The thirtieth was Sunday and very cold. On December 1st we took the transit, etc.

and drove to Crown Point. The day was occupied with measurements from the Light-House tower, and from the extremity of the carefully measured base-line of the U. S. C. S., having another coast survey station as zero to replace the Barber Point Light-House, which was still invisible. The measured base-line, which we were now able to use for the first time, was of great value, and permitted us to adjust the theodolite directly over the cross-cut in the metal, sunk by them in the rock at this station. While engaged in the work here we were annoyed about sunset, by the re-commencement of the snow storm in the west, which seemed to us to be the same as that which had been upon us for the last twenty days. However, as it began to obscure the sun we were gratified to behold an inimitable prismatic bow surrounding the image of the sun, and apparently not more distant than Bulwagga Mountain, some two miles west of us. The theodolite was turned upon it, and its greatest diameter — immediately measured — was found to be 46° 40′. The brilliancy of its colors made it unusually interesting.

On December 2, angular measurements from a coast survey station in Port Henry, perfected our design, and completed the field work of the survey for 1873.

On the 3d of December, we left Port Henry and returned to Albany.

GENERAL SUMMARY OF RESULTS

With deductions, remarks and suggestions, upon matters relating to the region under survey, noted during the progress of the work: of the physical capabilities of the wilderness region; of its true actual, relative and possible value to the State; together with explanations in regard to the great land patents, to previous surveys, and to the methods of work adopted in the present survey.

In a report, rendered so soon after the conclusion of field work, it is impossible to give more than an outline of all the results, and even incessant and continued industry during the time at command, will not render it possible to compute and place in proper form for publication, more than a portion of the measurements made. The limited time and assistance available, have rendered it necessary to select some portion of the work for present publication in tables, and preference has been given to the observed altitudes, which are attached with data and results of calculation, in the appendix.

If desired, the trigonometrical work will also be tabulated as the computations progress, and hereafter laid before the legislature.

The following chapters on hypsometry, hydrography, boundaries, triangulation, reconnaissance maps, and the conclusion refer to the more extraordinary results of the survey. Special subjects, the description of the illustrations, with the tables, etc., will be found in the Appendix.

HYPSOMETRY.

The present advanced condition of geographical and geodetical surveying may be said, indeed, to have created the science of hypsometry; for the modern geographer is unsatisfied with the mere latitude and longitude of a place, and demands an additional, vertical, co-ordinate; its altitude above the level of the sea; before he will allow that the physical relations of the place to the rest of the world have been properly and fully determined; and for this purpose in reconnaissances and explorations, the mercurial mountain barometer is without a peer.

Nevertheless, the object of the measurement of mountain heights, and of altitudes generally, is not apparent to those unacquainted with higher surveying, to whom the question of difference of level must always appear obscure, unless brought practically before them, as in the selection of a route for a roadway, over mountains where the most easy grades or inclines are sought, and the cost of transportation becomes directly proportionate to the difference of level to be overcome, rendering the road more or less difficult.

In modern meteorology, altitudes have daily to be taken into account, and proper allowance computed, before the weather probabilities can be ascertained, and the question of chance of storm on land or sea discovered.

Every determination of latitude with sextant and artificial horizon has to be corrected for the height of the barometer, etc., before the true latitude is known. In short, in a geodetical survey the greatest errors would arise if the altitudes were neglected; and without a system of checks by one method upon another, the survey of several thousand square miles of territory would be little else than guess-work. By our careful determination of altitudes, the *truth* in regard to the region is fixed upon paper; and the meteorologist has at his hand the data for his problems; the railroad projector, as though among the mountains themselves, can trace on the map the course of his projected railroad; the statesman can select the most favorable passes for great state improvements of canals, of water supply of cities, or of great highways; and the engineer and surveyor who is directed to lay out these works, will ascend to some mountain summit, and there, in the heart of the wilderness, near his work, find the *datum* which he must otherwise have obtained by a long and laborious series of levels from tide level, step by step, with telescope and target.

Of the value and effect of altitudes in agriculture I have already spoken briefly in the introduction. There is hardly a portion of the State in which there is not a difference in the estimated value of mountain and lowland farms; or a county containing elevated hills or mountains in which the inhabitants have not observed a difference in climate, even though slight, between mountain top and mountain foot. In our neighbor State, Pennsylvania, remarkable differences of temperature arising from altitude are recorded; for in the lowlands of that State the temperature of the air at midsummer has been known to exceed blood heat, and the approach of frost may be delayed till the winter months; while in the highlands during a comparatively cool summer, there is not a month free from frost.

This difference of climate through altitude is one of the great world wide powers in meteorology, and extends its influence over both the hills at the sea coast, and the gigantic mountain ranges of the Andes and the Himalaya.

In continuing the investigation of the value of altitudes in agriculture for this Adirondack region, I have made a careful analysis of the changes of climate attributable to difference of latitude along the meridians passing the eastern side of the wilderness. In order to accomplish this, it became necessary to examine into and collect from the records, the meteorological facts which are recorded, and from them evolve the desired information. For this purpose the only data are the statistics of the State agricultural reports and the meteorological records of the State academies as rendered to the Regents of the University.

The State agricultural records show that from New York to Albany, (a difference of about two degrees of latitude,) the approach of spring is delayed, on an average, one week; and we are also assured that the first killing frost of early winter appears in St. Lawrence county thirty-four days before it reaches New York city, or the western end of Long Island. (Which is equivalent in latitude to about four degrees.) This is of preliminary interest, showing the general difference in climate between the extreme southerly, the midway, and the northern portions of the State, directly owing to their difference in latitude; all these stations being at or near sea level.

The vast, trough-like, though irregular, valley which extends nearly along the meridian from Albany, on the Hudson, to Plattsburgh, at the northern extremity of Lake Champlain, forms the eastern limit or boundary of the Adirondack region; and the difference of climate between its northern and southern terminus may be adopted as the local variation or change attributable to the difference of latitude. To abbreviate the analytical examination of this question, I will limit it to a comparison of temperatures between the stations mentioned. For this purpose we have the meteorological data of the academies at Albany and Plattsburgh during a series of years; the two stations being at nearly the same altitude above tide level.

Albany Academy	Lat. N. 42° 31′.	Long. W. 73° 44′ G.
Plattsburgh Academy.........	Lat. N. 44° 42′.	Long. W. 73° 25′ G.
Difference in latitude.............	2° 11′.	Δ in time 1 *m.* 17 *sec.*
Each station above tide about		130 feet

The following table shows the difference between the mean temperature of the months of the year 1851 *at the several stations.*

A. D. 1851.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Albany	25.53	30.35	37.51	46.37	57.19	64.35	70.33	67.26	62.20	53.15	36.02	23.22
Plattsburgh	18.07	23.77	30.95	41.69	53.35	61.52	67.07	65.18	59.20	48.82	30.25	18.09
Δ	-7.46	-6.58	-6.56	-4.68	-3.64	-2.83	-3.26	-2.08	-3.00	-5.33	-5.97	-5.13

Temperature in Fahrenheit Degrees.

The mean difference for the year, 4°.71 Fah.

THE MEAN ANNUAL DIFFERENCE IN TEMPERATURE BETWEEN ALBANY AND PLATTSBURGH, FOR A TERM OF ABOUT TEN YEARS, IS EQUIVALENT TO 4°.41 FAH.

[It is well to bear in mind that the open water of Lake Champlain, at Plattsburgh, must moderate the cold of autumn and early winter at that station, to a greater extent than the Hudson can affect the temperature at Albany; but this does not greatly influence the mean temperature, for the ice lingers on Lake Champlain late in the spring, cooling the air.]

If we assume, on the basis of this analysis, that for two degrees of north latitude along the vast upper Hudson and Lake Champlain valleys, there is a mean annual decrease of temperature of 4° Fah. thermometer, we have *for this locality* a minus difference of two degrees of temperature for one degree of north latitude! The most careful re-examination of the data leads only to the same result. In order to make a comparison of practical value to agriculturists, we have next to determine the local decrease of heat for increase of altitude.

Every one is aware of the uniform decrease of temperature as we ascend into the atmosphere. As the preceding analysis has made it evident that along two degrees of latitude there is for this Adirondack region a decrease of heat equal to 4° Fah. (or 1° Lat. to 2° Fah.), it becomes apparent that for every decrease of 2° of temperature, Fahrenheit, as we ascend from sea level, we have reached a region having the mean temperature, if not the mean climate, of the country which is one degree of latitude, or about sixty geographical miles further north. In short, that a decrease of two degrees of temperature, Fahrenheit, by altitude, is equivalent to one degree of north latitude. The proportion of decrease of temperature to feet of altitude, therefore, only remains to be ascertained in order to enable us to estimate the difference of climate at different altitudes.

This proportion varies in different localities. In South America Humboldt found that it was 1° cent. (=1°·8 Fah.) for every 191

metres ($626\frac{64}{100}$ feet) in the mountains, or $243\frac{1}{2}$ metres ($798\frac{88}{100}$ feet) on the plains. [Also; 1° Fah. = 348 feet in mountains, or 443 feet on plains.] In Hindostan, among the mountains of northern India, the observations give nearly the same figures, and analogous results have been obtained among some of the mountain ranges of the United States. There are certain niceties which enter into this question; the temporary temperature changing with the variation of atmospheric pressure shown by the barometer, the rule of decrease of temperature being modified at great altitudes, etc.: but these are matters for which there is no present space for discussion; the greatest altitudes in the Adirondack region but little exceeding 5,000 feet. From aeronautical investigations, under the auspices of the British Association for the Advancement of Science, it was estimated that near London an ascent of 5,000 feet was equal, *with clear sky*, to a decrease of 1° Fah. to each 239 feet of elevation; or *with clouded sky* to a decrease of 1° Fah. to each 271 feet of elevation. The mean would be about 250 feet to 1° Fah. decrease of warmth, or a difference of minus 20° for 5,000 feet of elevation. The observations of Von Humboldt, however, indicate a change of about 1° Fah. for every 400 feet of elevation; but his observations were taken within the torrid zone and far inland.

For a further elucidation of the problem I turn to our own observations, comparing them with the records of the nearest United States Signal Service Station on Lake Champlain, at Burlington, Vermont, which is visible from some of the mountains below mentioned. A few examples only, however, can be given.

Mt. Marcy, August 24, 1873; elevation, 5,402 feet, or about 5,200 feet above Burlington station.

$$\text{4.35 P. M.} \left\{ \begin{array}{llll} \textit{Burlington,} & \text{temp. of air} & 65° & \text{Fah.} \\ \textit{Mt. Marcy,} & \text{“} \quad \text{“} & 46° & \text{“} \end{array} \right\} \text{Clear and cold on Mtn}$$

$$\Delta = 19° = \text{(colder on the mountain).}$$

Mt. Haystack (about 5,006 feet), August 26.

$$\text{2.00 P. M.} \left\{ \begin{array}{lll} \text{Burlington,} & \text{temp. of air} & 64°. \\ \text{Mt. Haystack,} & \text{“} \quad \text{“} & 47°.5 \end{array} \right.$$

$$\Delta = 16°.5 \text{ (colder on the mountain).}$$

$$\text{4.35 P. M.} \left\{ \begin{array}{lll} \text{Burlington,} & \text{temp. of air} & 66° \\ \text{Mt. Marcy,} & \text{“} \quad \text{“} & 48°.5 \end{array} \right\} \text{Cloudy and raining.}$$

$$\Delta = 17°.5 \text{ (colder on the mountain).}$$

Mt. MacIntyre (about 5,201 feet), September 3.

$$\text{12 M.} \left\{ \begin{array}{lll} \text{Burlington,} & 65°\cdot0 & \text{Fah.} \\ \text{Mt. MacIntyre,} & 49°\cdot0 & \text{“} \end{array} \right\} \text{Clear and cold.}$$

$$\Delta = 16° \text{ Fah. (colder on the mountain).}$$

Same (*same date*), in afternoon.

Burlington, 71° 0 Fah. } Clear and cold.
Mt. MacIntyre, 56° 0 " }

$\Delta = 17°$ Fah. (colder on the mountain).

The mean difference of temperature upon these exceptionably favorable days and times of observation, equals 16°·8 Fah. The difference of longitude between these stations is only equivalent to two or three minutes of time.

If we assume the mean difference of latitude of these mountain tops from the parallel of Burlington to be 20′ or one-third of a degree, this mean difference of temperature will require correction for that difference of latitude, equivalent to —0·6 of a degree Fah., and 16°·8 — 0°·6 = 16°·2 Fah. = the true difference of temperature between these mountain tops and the approximate sea level in the same latitude, offsetting the height of the lower station (about 200 feet) against the few hundred feet by which the mean height of these mountains exceeds 5,000 feet, we have approximately Δ 16° Fah. = 5,000 feet altitude, or 1,000 feet altitude equals 3°·2 Fah., which being a result obtained during summer and autumn, is probably two or three degrees less than the annual mean which the severity of winter on the mountains would create. Whence we perceive that Mt. Marcy, *with a height of* 5,402 *feet*, might be assumed to have for each 1-5th of its altitude a difference of temperature equivalent to 4° Fah., or for whole height = 20°, and being the loftiest peak of the range, this should be, of course, the greatest difference of temperature by altitude possible in the State. If so great a difference in relation to heat is found to exist during summer, what must it be in mid-winter when the bitter arctic cold penetrates into the very rock of the peaks! Receiving less heat in summer than the lowlands, and consequently having less to radiate in winter to moderate the cold, it seems to me that the difference of temperature for altitude *must* increase in winter, and it is this question which I hope in some measure to solve by the recording thermometer left upon the summit of Mt. Marcy.

To recapitulate: it has been shown that —

Along the meridian between Albany and Plattsburgh the mean difference of temperature, owing to difference of latitude, is = 4°.41 Fah. Also, that for this locality one degree of north latitude is equivalent to a mean decrease of temperature = 2° Fah. Also, that for the crest of the Adirondacks (5,402 feet), by my observations, we have a mean decrease of temperature, owing to altitude, probably equivalent to 20° Fah. Also, that in regard to the influence of altitude, our observations here indicate that even in summer a decrease of heat for each thousand feet of ascent, is equivalent to $3°\frac{2}{10}$ Fah. Every indication points to a still greater difference; and I am led to suspect that had we the mean temperature of the whole year at altitudes of from one to five thousand feet among the mountains, the rough difference between the temperature at these mountain stations and the temperature at sea level in the same latitude and vicinity, would be 1,000

feet altitude ..... = ... 4° Fah. temperature.* Assuming this to be the true mean difference, we are brought to the startling conclusion that 1,000 feet of elevation is, in this region at least, equal to two degrees of north latitude! For instance — more simply — that it is two degrees Fah. colder one step of latitude north and four degrees Fah. colder 1,000 feet up in the air!

Now if Δ 2° Fah. is equal to one degree of north latitude, a minus Δ 20° Fah. (for altitude Mt. Marcy) must be equal to ten degrees of north latitude along the eastern border of the wilderness. Mt. Marcy, therefore, near latitude north 44°, having an altitude of 5,402 feet above tide, should (if the conditions remain the same along a line northward) have the mean temperature and local climate for its summit equal to north latitude 54°, or about the latitude of the Esquimaux *In-vuck-to-ke* inlet in Labrador, on the coast of the iceberg sea! From long acquaintance with the summit of this peak, of its peculiar alpine flora, etc., I am able to prove that it actually possesses such a climate.

Nevertheless, in a region like the Adirondack, the difference of the mean temperature in the mountains, from the mean temperature of the lowlands, does not render apparent those occasional severities of cold, which even at midsummer suddenly sweep down from the north and settle — perhaps only for the night — over the region; on highlands conquering and killing with their frost all tender vegetation, leaving fields, which but the day before were full of promise, now blighted and withering desolations. Such frosts are more potent in hindering agriculture than the lowness of mean temperature, and must always render these uplands a repulse to settlements for farming.

Thus, from the rich and extensive farms of the Mohawk, and the Hudson; of the broad and fertile plains bordering Lake Champlain, the equally rich and productive lowlands of St. Lawrence, Jefferson, Lewis and Herkimer counties; we ascend, step by step, one long slope upward into a wilderness, whose altitude is its great impediment to agricultural growth.

By a reference to the accompanying table of altitudes,† as determined by our barometrical measurements, the farmer or purchaser of farming lands upon the margin of the wilderness, will be able to tell by examination of the map the elevation of the lands offered him for sale, and their value for agricultural purposes, and thus the practical value of the mountain barometer in agriculture, through the heights found by it, becomes at once apparent.

For practical purposes I may state that even upon good lands in this region

Corn (maize) cannot be profitably cultivated at an altitude of 1,500 feet above the sea.

Buckwheat must be looked to, for fear of early frosts at 1,000 feet above the sea.

Oats are unprofitable at 2,000 feet above sea level, though growing very thriftily in some sheltered valleys at 1,600 feet.

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* These remarks are of a local nature, relating solely to the Adirondack region, having no application to the great elevated plains of the west, etc. — of Colorado or Wyoming — where the isothermal lines and hygrometrical conditions are different, and where this branch of meteorological phenomena is greatly modified by the peculiar physical features of the great plains and the Rocky Mountains.

† See page 87.

Potatoes are not known to have been profitably grown over 2,500 feet above the sea, though there are small sheltered localities where they might possibly be grown.

Garden vegetables have been frost bitten in July and August, on good lands, at 1,500 feet above sea level.

These are my own personal observations; the first, I believe, ever recorded upon this subject of the Adirondack region. Guided by these suggestions, the investigator may, by a careful study of the final map and contour lines, obtain a good general idea of the slender agricultural capabilities of this wilderness and its settlements.

It would seem advisable in all future assessments of farming lands on the margin of this wilderness, that the question of altitude should be taken into account in the valuation by the assessor, in order that persons owning elevated land, which affords them but little return, may be relieved of any excessive or undue taxation.

In determining the altitudes throughout the region during this season, a vast number of hypsometrical observations were taken on the different instruments. In each barometrical observation the cistern of the instrument was first lowered by the cistern screw, then raised and brought to zero, the vernier immediately adjusted, and the reading of the temperature of the barometer taken and of the external air thermometer, and afterward the reading by the vernier recorded in the field book. The hypsometrical field books were prepared under my directions in the following printed forms, which greatly aided the observers in recording the readings.

The blank is filled with an actual observation.

Summit of Bartlett Mountain; on trail, August 23, 1873.

TIME.	BAROMETER.	ATT. THER.	DET. THER.	REMARKS.
3.15 P. M.	*26.356"*	*50°.5 Fah.*	*51°.5 Fah.*	*Raining; no wind.*

Over eight thousand seven hundred (8,700) observations were carefully taken in the manner above described, at the different survey stations for barometrical leveling during the year.

I cannot here refrain from calling attention to hardships and labor encountered in this branch of the service, in the field work of the second and third divisions. Young men ardent to engage upon this survey, in order to participate in discoveries and adventures — which at distance seem to them to have irresistible fascinations — have felt aggrieved at my refusal to accept their services even in this department. They cannot be aware that those who are unaccustomed to labor in the wilderness, can afford but little "assistance" upon a survey; but instead, by illness, timidity, exhaustion, and lack of tenacity and experience they would become a clog and a burden upon the work. It is only those who have an actual interest in persistent, even though tedious, scientific labors, that experience enjoyment in the midst of such hardships. Were they to behold the observer on barometer

at lower station at his work, upon his knees on the marshy shores of some dark, solitary, and lonesome lake of the wilderness, studiously and anxiously taking and recording — watch in hand — observations on the instruments at intervals of five minutes*, from early dawn till the gloomy hour when the hoot of the owl tells the approach of night; day after day alone at his station, companionless, and inclosed by the deep awful silence of the wilderness; his lunch a crust of bread, baked a week or ten days previously; only at evening rejoined by his tired associates in labor who have been as busily engaged at some other distant lake or station; they would neither envy nor covet his employment. No. Kneeling in the wet moss of the woods day by day, keenly watching each oscillation of the quicksilver; now prostrate on the moss peering through the glass walls of the cistern, and by slow motion of the screw bringing the gleaming pool of mercury to the zero point — eyes strained by dim light of the forest — reflecting with one hand a trifle of light across and through the tube, while with the other hand the vernier is nicely adjusted; bating his breath through fear of raising the temperature of the thermometer which he quickly reads; the labors of the hypsometer are arduous.

He must each day, at close of work, put up his instruments with care, and carrying them as cautiously as one whose pockets are filled with eggs, make his way to camp through thickets and over rocks and fallen timber, where evening shadows make each step a snare. In camp he must bestow these instruments where by no possibility, axe, tree, or limb may be thrown against them in the cutting of night wood by the guides; and he must have care, if he bestow them within the shanty, that some tired individual does not drop himself to rest directly upon them. The field-work is in the summer season sufficiently laborious; but when, as on the third division, it was continued amidst the snows of winter it became painful and even dangerous; only an intense desire to complete the survey this season and to avail myself of all opportunities for measurement, induced the continuance of work. Half reclining in the snow on the frozen surface of some lake — the temperature 10° or 20° below freezing — penetrated by the cold; handling the chilly metal of the instruments with fingers benumbed; with aching feet encased in boots recently wet in crossing some rapids, and now frozen hard as boards; deprived of the luxury of a fire which might affect the temperature of air near the instruments — the hypsometer who continues his labors in the winter must indeed have the success of his work at heart.

The eight thousand seven hundred hypsometrical observations thus made in the field form the basis from which the altitudes have been computed. For the determination of the altitude of "lower stations" in the interior of the wilderness, as bench marks for subsequent work, long and continuous series of observations were taken by the assistants placed at these midway stations, and by the exactly synchronous observations, principally of the Dudley Observatory, at Albany, their altitude above sea level has been computed. In this manner stations for corrections, or of record of change of atmospheric pressure have been made at different points in the valleys, amid the peaks; and the

* Only such long series of observations can insure accuracy in measurement. This I have proved repeatedly, experimentally, during the past season, numerous single observations being computed showing the fallacy of imperfect observations.

assistants have continued during the progress of hypsometrical work in the neighborhood, to take observations at appointed intervals.

In order to make use of the whole of the short season at my disposal, the observations for determining the altitude of these midway bench marks proceeded at the same time with the other leveling; all the time in the field being devoted to the observations and measurements. At the close of the season, therefore, there was upon hand the whole mass of observations accumulated during the year; forming two considerable volumes; and it became necessary that I should personally arrange all this data and compute it into altitudes; no one besides myself understanding the scheme of the survey, or the intricate system of upper and lower and midway stations, of levels and of bench marks.

Before the mean altitude of any of the lower stations could be computed, it was necessary to procure a complete series of hourly barometrical and thermometrical observations at tide level during the season, which extended from July to December, 1873. For this purpose previous arrangements with the Dudley Observatory, at Albany, had been made through the kindness of the director, Professor George W. Hough, to whom I am also indebted for the supervision of the work of the copyist employed by me at the Observatory.

Subsequently, in order to elucidate some important hypsometrical problems, copies of the records of the United States Signal Service Stations at Burlington, Vt., and Oswego, N. Y., were obtained through the courtesy of the Chief Signal Officer of the War Department, and my thanks are specially due to Capt. H. W. Howgate for his courtesy and promptitude in furnishing the desired data, which have proved of the greatest importance, rendering visible certain remarkable local atmospheric fluctuations, before only suspected.

With the aid of these observations reduced to sea level and 32° Fah., I have made an extended and careful examination by computations with our hypsometrical records — in this region, intermediate between those stations — and have obtained most interesting results. The center of this region I have found is often the axis of fluctuation; the swaying of the atmosphere, as shown by the barometerical observations, being most remarkable, and resembling the tiltings of a great circular plane having a small central axis attached, on which it is nicely balanced, but ever tilting and falling to the right or the left, as with the wind: now lowering its rim eastward toward Burlington; now suddenly settling to the west toward Oswego; and anon rolling southward and tipping toward the Dudley Observatory: at one time rendering some meridian of longitude the line of least atmospheric disturbance, and at another changing this to some parallel of latitude; it is readily seen that the phenomenon is of the greatest importance in hypsometry. With a view to ascertain the existence, extent and constancy of this phenomenon, I have selected occasions where the stations in the interior of the wilderness have a *known altitude*, and have compared the observations taken (reduced to sea level) with the synchronous records east, west and south, of Burlington, Oswego and the Dudley Observatory. When, upon this comparison, there was found to be atmospheric disturbance at the Dudley Observatory, and at the same time a steady atmosphere at Burlington, Vt., and Oswego, N. Y. — and along the line

between them — the mean of the readings at these easterly and westerly stations was taken, (if the wilderness station were about midway between, say along near the Hamilton and Herkimer county lines,) and the altitude computed on this basis, the height resulting from the computation being almost exactly the known altitude. Where the wilderness locations were not midway, the greatest weight was given to the observations at the nearest station; the difference between the readings of barometers and thermometers at Oswego and Burlington being divided by the number of miles distance, and this proportional difference being added to or subtracted from the readings of those signal service stations, as the conditions of the problems demanded.

The results of my investigations are; that the maxima and minima of atmospheric pressure do not always occur contemporaneously along the same longitude *here;* and that an area of either high or low pressure does not constantly exist *here;* but rather that the atmospheric phenomena are much more complicated; and that while both of these conditions do occur, they are occasionally superseded by a line of maxima or minima extending east and west along some parallel of latitude. The absolute necessity, therefore, of checks upon the Dudley Observatory data, by Oswego and Burlington, are apparent.

The observations at both the upper and lower field stations were uniformly computed directly with the Dudley Observatory synchronous readings, and the difference of the height found by this "time observation" for lower station from the true mean height of the lower station, was afterward added or subtracted as the case required. This method of computation shows first the height which would be obtained for a mountain by a direct comparison with the Dudley Observatory, and second the difference which the computation by the data of the near lower station, at the mountain foot, would give. In the tables of results of hypsometrical calculations, the reductions by "time altitudes" of Panther Gorge are given at some length, during different days, and will sufficiently explain this matter. The importance of such near, lower stations for accuracy, is made evident by the differences shown; the local excess or depression being at times equivalent to 60 or 70 feet, for which these *near* lower stations afford the proper correction.

Whenever, through necessity, the altitude of a station was directly computed with a distant station at sea level, a careful scrutiny of the records of the three Observatory stations mentioned was made, and the best data, (preferably the similar readings of two sea level stations against the high or low pressure reading of one alone,) were selected for the reduction.

In my previous report, allusion was made to the method of measuring mountains with barometer without ascending them, their level being taken from the side of some superior mountain, and the altitude of the station computed as though it were the summit of the distant mountain, with certain additional corrections. The peculiarity of my method, however, was not fully explained. It consists in always accurately determining — by methods hereafter described — the distance from the station on the mountain side to the mountain summit whose level has been found. Unless full and careful attention be given to this matter, the altitude obtained will be inaccurate and

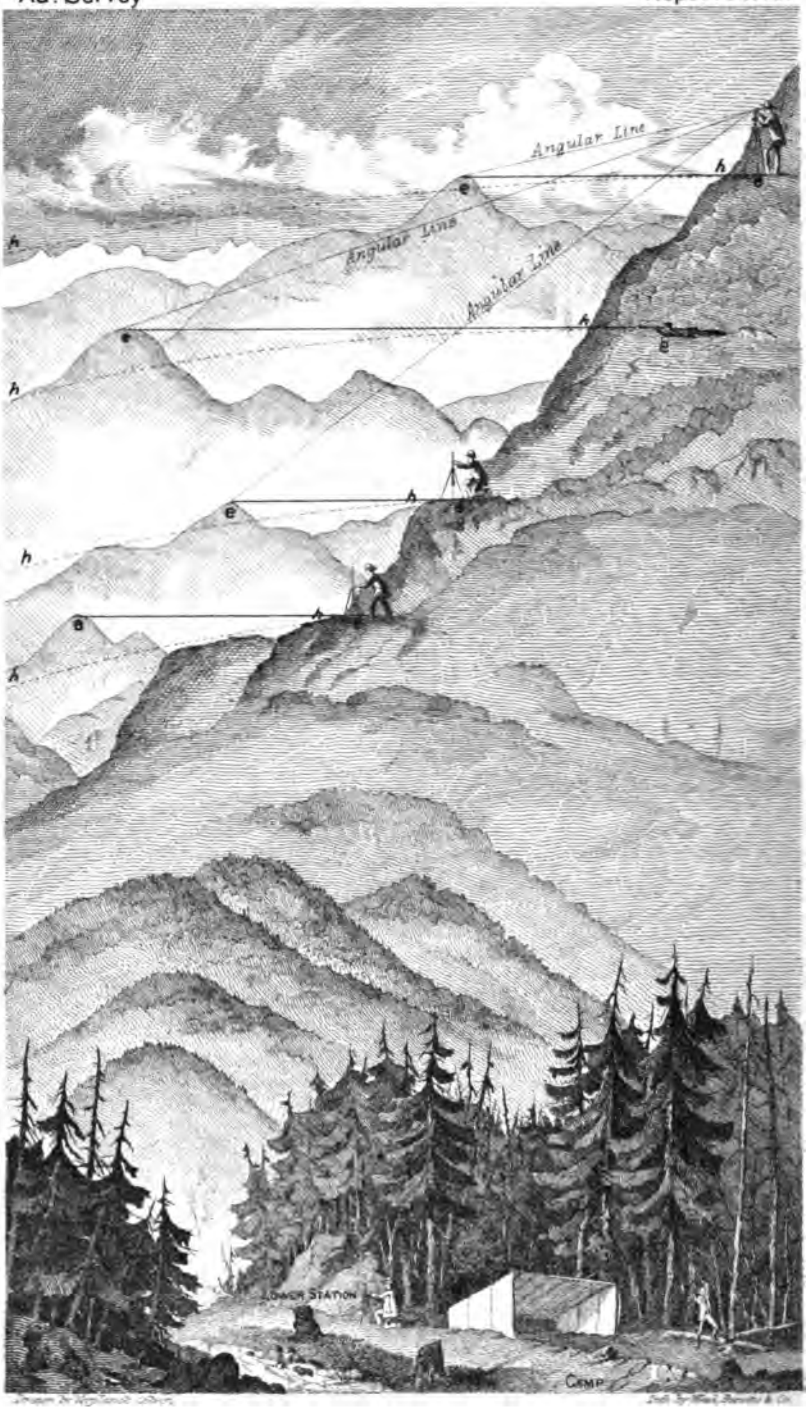
worthless — except at inconsiderable distances — it being impossible to apply the proper corrections for the curvature of the earth and for atmospheric refraction. The rationale of this method may be explained by reference to the illustration (plate 7), which is a sectional view of a few of the Adirondack peaks, and which were stations actually used in this manner of leveling.

Upon Mt. Marcy — in the illustration, plate 7 — we have stations a, b, and c; which are apparently at the same level or height as the summit of the distant mountains *a′ b′*, and *c′*. The vertical lines a, a, and *a′ a′*; b, b, and *b′*, *b′* being theoretically of the same length — it would seem at first sight, that if the vertical height b, b, were measured, the corresponding altitude b′, b′, from sea level would be made known. Now, as the upper horizontal line b to b′ (the line of sight of the telescopic level) is really not a level but a right line, tangent to the *curved level* surface of our globe, it leaves the surface of the earth at the station on Mt. Marcy, and constantly widens the distance between it and the curve of the earth as it advances. For this curvature of the earth from a straight line it is necessary to add a variable quantity in feet (or fractional parts thereof) *in proportion to the distance of the object sighted upon.* But it is not the curvature of the earth alone — lowering the object from our sight — that we have to deal with, the question is complicated by the action of the air which (by that same refraction which makes a straight stick appear crooked when half way in water) now raises the mountain sighted upon slightly higher in appearance to the eye. The value or effect of these influences will become more evident by an examination of the following table of corrections for curvature and refraction along such a tangent at sea level .

MILES.	1	6	13	100
Curvature of earth (+) ....in feet	+ 0.6670	24.0120	112.7230	6670.00
Refraction of atmosphere (—) .... "	— 0.0953	3.4303	16.1033	952.86
C. and R. combined............ .... "	+ 0.5717	20.5817	96.6197	5717.14

It will be seen that in 13 miles the curve of the earth has already fallen below the straight line of sight of the leveling telescope $112\frac{72}{100}$ feet, while the refraction of the atmosphere has, in the same distance, acted in the reverse direction apparently to the extent of $16\frac{10}{100}$ feet; it being necessary, therefore, to add $96\frac{61}{100}$ feet to the measured altitude in order to obtain the true height of the distant mountain. This is sufficient to make it apparent that, even for rapid reconnaissance leveling, the distances must be known in order to obtain accurate results.

My method has been for short distances, to carefully measure on the mountain side a base-line with steel tape, and from its extremities take the angular position of the object, afterward computing the distance. For very distant mountains an adaptation of tri-linear surveying has been employed. From the station of the barometer the angles between any three of the surrounding peaks, whose positions I have before found trigonometrically, are measured, and afterward by three-point problem (usually graphically upon the survey map) the distance is obtained and the proper allowance made for curvature and refraction. Now that we



PLAN SHOWING METHOD OF

Mountain Measurement with barometer and spirit-level Distances by Triangulation

have so many trigonometrically determined points throughout the region the tri-linear method is found not only the easiest, but the most accurate. Our last true or exact application of my method with steel line and sextant was that upon the side of Mt. Dix (the upper horizontal line 6 to e on Plate 7) to Nipletop, *e* of the illustration. The military topographer in time of war, will find the latter method the readiest for ascertaining his distance, unless he uses the prismatic telemeter; which, however, is only reliable for short ranges.

The practical application of this method to the work of the survey is well shown by the illustration, plate 16, which represents a survey party engaged in leveling observations with mountain barometers, at the *levels* of the different peaks seen in the distance. At *A* is seen the transit, by which the horizontal angular distances between three of the distant peaks are measured in order to obtain the data for correction for curvature and refraction. Below, on the same mountain side at e, e, and e, are stations of barometers at the apparent levels of the peaks by the lines of sight level.

At the foot of the mountain is the bark camp, and the assistant observing on barometer at lower station: a guide near by is cutting night wood for camp.

The sight lines or lines of apparent level (e —— to —— e) are taken from points on the mountain side, which are really lower than the distant peaks; for, following to the left the curve of the earth from the barometer station (h .... to .... h) it will be seen to descend below the level of the peaks in proportion to their distance — the true level of the distant peaks being the curved dotted line of equal height —above sea level, evidently considerably higher than the stations of their apparent level. The effect of refraction is not shown in the illustration. In practice, the observer on barometer at the lower station takes observations upon his instrument and the attached and detached thermometers every five minutes, and (whenever possible) similar observations are taken on the summit of the peak above the intermediate leveling stations, affording both a lower and an upper station when well determined. The observations, therefore, taken at any five minutes will be synchronous with those taken on the mountain sides, at leveling stations, or on the peak above; they can then be computed as usual, by the upper or lower station records, and by the tri-linear measurements, the proper corrections for curvature, etc., made, and the true height of the distant peak is found.

Among the atmospheric phenomena which most attracted my attention during the season, was an apparent excess of pressure and temperature in the deep valleys and ravines, very notable at times in the Panther Gorge; a chasm walled in on one side by Mount Marcy, and on the other by Mt. Haystack, and having a depth below those summits of about two thousand feet. While I have given this matter much consideration; the general work of the survey requiring my close attention; I am not yet prepared to place the result of investigation before the public. It may, however, be said, that there is apparently in this deep chasm valley, a slightly denser atmosphere than its altitude would warrant us to suppose; and my endeavor has been to ascertain whether this is a constant phenomenon.

The experiments of Maskelyne at the Schichallion cliffs, demonstrated the existence of horizontal attraction, by the drawing of the

plummet in from the true vertical line toward the rock-mass; and some indications in our observations in the Panther Gorge and on the cliffs above tend to show at times a similar horizontal gravitation of the atmosphere toward those great, massive mountains; a sort of surreptitious packing away of a few pressures of atmosphere, in an attempt to fill with slightly denser air this Chasm-Gorge, which lies like a semi-vacuum between the immense granite mountain walls.

Without, at this time, entering into a further discussion of this subject, I will say that it would appear from our examination, that barometrical observations taken in such deep valleys, are more subject to irregular changes by "jumping," than on the mountain crests, and I have acquired a preference for *upper stations* (or upper bench marks) for corrections on open crests — when well determined — to lower stations in deep mountain-locked valleys. The effect of such local atmospheric disturbance in deep valleys, selected as lower stations in the barometrical measurement of mountains, cannot but be deleterious. It may be found necessary to make peculiar corrections for such stations; and it may be that in the investigation and search for the co-efficient of correction, a means may be found, by which the weight of the granite mountain masses inclosing a valley may be estimated indirectly from readings of the barometer, if this lateral or horizontal gravitation of the atmosphere exists as suspected.

The results of the hypsometrical branch of our field-work are extensive and important. We have now four volumes of records of observations taken at different stations, everywhere at most important points in the wilderness. The heights of passes, of lake levels and of mountain peaks will be found in the accompanying table of altitudes; which is a list of the more important points measured during this survey. Whenever, on the margins of the wilderness, or at the level of well known lakes, the datum of some explorative railroad line of levels has proved correct, I have accepted those measurements, and thus have saved time for leveling work in the less known sections. Nevertheless, were I to be assured of the continuance of this survey, with proper aid for any length of time, it would be my care to re-determine, and connect, as far as might be, all these levelings into one harmonious system.

The consideration of the great mountains which have been this season for the first time measured, is deferred till the conclusion.

The barometrical method of determining differences of level has, in these explorations, as in others, proved to be the only one available. The *mercurial barometers* have been solely relied upon in measurements, the *aneroids* of the very best construction proving unreliable. It should be kept in mind, however, that a few single observations do not constitute a determination of altitude, even if synchronous with a near lower station, and that only by a long series of simultaneous observations can exactness be approached. The greater number, therefore, of accurate observations of the instruments with favorable atmospheric conditions, the better the results. It is my opinion that the mountain heights are good determinations — to be yet tested, however, by the trigonometrical work — but the smaller differences between lakes or lowlands, where our measurements have been so far only explorative, may be slightly in error, though not more than the $\pm$quantity which Humboldt allows in all barometrical measurements.

PRELIMINARY HYPSOMETRICAL RESULTS.

TABLE

Of heights above sea level of some of the important points in the Adirondack Wilderness; measured and computed by, or under the superintendence of *Verplanck Colvin*:

Title.	Height above tide.
Adirondack village (Main street)	1,836.40 feet.
Aiden Lair (upper hotel)	1,700.56 "
Ampersand pond	2,078.80 "
Ampersand mountain	3,432.62 "
Andrew mountain	3,216.48 "
Ausable pond (upper)	2,064.62 "
Avalanche lake	2,856.44 "
Baldface mountain (No. 1)	3,903.60 "
Bald mountain	2,302.35 "
Bald Peak (Moriah)	2,120.06 "
Balm of Gilead mountain (S. Mountain)	1,953.47 "
Bartlett mountain	3,715.31 "
Basin mountain	4,905.54 "
Beach's or Brandreth's lake	1,913.79 "
Beaver Meadow pond (source Oswegatchie)	2,193.97 "
Bennett's pond	1,985.45 "
Blue mountain	3,824.95 "
Blue Mountain lake	1,821.81 "
Bog lake	1,755.48 "
Boquet river (level) at Elizabethtown	496.13 "
Boquet river (Upland valley)	2,425.45 "
Boreas pond (middle) approx	2,046.40 "
Boreas pass (approx)	2,066.40 "
Burnt mountain (No. 1)	2,121.56 "
Calamity pond	2,712.17 "
Camel's Hump mountain	3,548.38 "
Camus pond	1,991.52 "

Title.	Height above tide.
Caraboo pass	3,662.54 feet.
Cat mountain (Oswegatchie) only approx	2,336.40 "
Cedar lakes	2,529.80 "
Cedar river falls	2.135.09 "
Cedar river settlement	1,706.51 "
Chain ponds (Bog R.)	1,736.74 "
Chapel pond	1,551.21 "
Charley pond (Beaver river)	1,752.58 "
Clear lake (Red Horse chain)	2,005.93 "
Clear pond (North Elba)	2,159.49 "
Clear pond (Long lake)	1,691.18 "
Cobble hill	1,936.37 "
Colden (Mount Colden)	4,753.14 "
Colden (Lake Colden)	2,770.39 "
Colvin lake	1,990.76 "
Colvin (Mount)	4,142.00 "
Cow-Horn pond	1,772.38 "
Crain's mountain	3,289.17 "
Cranberry lake (great)	1,540.93 "
Crooked lake	2,022.47 "
Crystal lake	1,663.45 "
Devil's Ear mountain	3,903.60 "
Discovery (Mount)	1,582.70 "
Discovery (Little Mount)	1,375.50 "
Dix (Mount)	4,916.01 "
Dyke falls; crossing	2,788.82 "
Elizabethtown (Station river level)	496.13 "
Elk lake	2,052.76 "
Elk pass	3,302.72 "
Evergreen pond	1,980.11 "
Fourth pond (Bog river) approx	1,756.40 "
Fairy ladder falls	3,111.00 "
Giant of the Valley (mountain)	4,530.35 "
Gothic mountain	4,744.15 "

Title.	Height above tide.
Graves' mountain	2,345.29 feet.
Graves' pond	1,795.98 "
Grass pond	1,750.50 "
Grasse river ford	1,452.54 "
Gray peak (aneroid)	4,984.37 "
Gray peak (by level, etc.)	4,902.64 "
Great plains	1,637.99 "
Gull lake	2,018.88 "
Gull pond (Little)	1,907.84 "
Harrington pond	1,779.68 "
Haystack mountain	5,006.73 "
Haystack mountain (little)	4,854.71 "
Henderson (Lake Henderson)	1,874.66 "
Hitchings pond (time alt's)	1,733.70 "
Hoffman (Mount) *approx*	3,727.78 "
Holmes hill	2,121.90 "
Hopkins' peak	3,136.91 "
Horse-shoe pond	1,712.61 "
Hunters pass, The	3,247.73 "
Hurricane mountain	3,763.32 "
Indian Face (Ausable ponds) approx (?)	2,536.40 "
Indian lake (Hamilton county)	1,705.74 "
Indian pass (center)	2,937.90 "
Indian Pass (top precipice, Wallface Mt.)	3,870.85 "
Iron Works (Upper Newcomb)	1,805.68 "
Jackson hotel (Cedar river)	1,706.51 "
Jessup's river crossing (State road)	1,763.92 "
Keene Flats (Dibble's hotel)	963.21 "
Keene Flats (Beede's)	1,240.60 "
Keene Flats (Phelps)	1,049.36 "
Lewey lake (of Jessup's river)	1,738.33 "
Lewey lake mountain (see Snowy)	3,903.60 "
Long pond (Oregon)	1,960.96 "

Title.	Height above tide.	
Long pond mountain	2,268.85	feet.
Long pond (Catlin waters)	1,609.10	"
LONG LAKE	1,620.48	"
Long Tom mountain	2,604.28	"
Lost lake (Oswegatchie)	1,761.33	"
Macomb's mountain (by level, etc.)	4,371.25	"
MacIntyre brook (crossing) trail Indian pass	2,173.95	"
Mason lake	1,860.42	"
Mineville	1,374.15	"
Minnie Pond	2,131.18	"
Mirror lake (13)	1,985.45	"
Mount Skylight	4,977.76	"
Moose lake	2,239.21	"
Moose Mountain (Ampersand Mtn)	3,432.62	"
Moss lake	4,312.22	"
Mount Clinton	4,937.79	"
Mount Colden	4,753.14	"
Mount Colvin (See C.)	4,142.00	"
Mount Dix (see D.)	4,916.01	"
Mount Haystack	5,006.73	"
Mount Hoffman (see H.)	3,727.78	"
Mount Hurricane	3,763.32	"
Mount MacIntyre	5,201.80	"
MOUNT MARCY (Mt. Tahawus)	5,402.65	"
Mount Maxham	2,510.54	"
Mount Redfield (see R.)	4,688 20	"
Mount Seymour	3,928.82	"
Mount Seward	4,384.70	"
Mud lake (Bog river)	1,745.33	"
Mud pond (Blue Mt.)	1,968.66	"
Niger lake (Red-horse Chain)	1,842.16	"
Nipple Top mountain	4,684.25	"
North Elba bridge	1,671.42	"
North River mountain	3,758.75	"

Title.	Height above tide.
Otter pond	1,959.66 feet.
Ouluska Pass (near Mount Seward)	3,086.85 "
Oven lake	2,025.45 "
Owl's-Head mountain	2,825.41 "
Panther gorge (mean station in)	3,378.71 "
Partlow lake (only approx.)	1,836.40 "
Placid (Lake Placid), Essex county	1,990.98 "
Pleasant (Lake Pleasant)	1,615.32 "
Preston ponds (upper)	2,206.35 "
Puffer pond	2,229.65 "
Ragged mountain (summit)	4,163,21 "
Raven Hill (mean)	1,982.22 "
Raquette lake (taken on the ice)	1,766.25 "
Redfield (Mt.)	4,688.20 "
Red Horse Chain (see Salmon lake)	1,756.48 "
Rift Hill (Lake Pleasant)	2,141.10 "
Round Lake (Bigbrook, Hamilton county	1,922.37 "
Round lake (middle Saranac lake)	1,576.15 "
Round Mt. Notch	2,546.43 "
Rustic Lodge (Whiteface Mountain)	4,116.60 "
Saddle mountain	4,536.40 "
Salmon lake (Red Horse)	1,756.48 "
Sandford (Lake Sandford)	1,721.86 "
Santanoni mountain	4,644.14 "
Santanoni (camp)	3,044.07 "
Saranac lake (upper)	1,605.99 "
Saranac lake (lower)	1,556.63 "
Scott's ponds, No. 1	3,091.30 "
Scott's ponds, No. 2	3,168.39 "
Second lake (Bog river)	1,736.74 "
Seward (Mount Seward)	4,384.70 "
Seymour (Mount Seymour)	3,928.82 "
Silver lake	1,983.32 "
Silver lake mountain	2,604.28 "
Skylight mountain (nearly 5,000)	4,977.76 "

Title.	Height above tide.	
Smith's lake (Beaver river)........................	1,774.72	feet.
Smith's ledge (also known as Ball mt. or Pratt's rock),	2,273.34	"
Snowy mountain..	3,903.60	"
South mountain (Balm of G.)........................	1,953.47	"
South McIntyre mountain............................	4,937.79	"
South pond (Hamilton county)......................	1,769.83	"
Speculator mountain.................................	3,041 37	"
Spring on Ampersand mountain....................	2,966.07	"
Spring pond (Bog river).............................	1,809.01	"
Stillwater (Beaver river)............................	1,656.65	"
Stony pond (Big brook), west of Long lake........	1,680.00	"
Summit-water pond..................................	4,326.69	"
TAHAWUS (Mt. Marcy)...............................	5,402.65	"
Tear of the Clouds (lake), mean..................	4,326.69	"
Thirteenth pond.....................................	1,953.47	"
Third pond (Bog river).............................	1,737.50	"
Three Pound pond..................................	1,802.91	"
Tupper's lake..	1,554.29	"
Tupper's lake (little)................................	1,737.58	"
Upland Valley (Boquet R. crossing)...............	2,425.45	"
Wardwell's Pond.....................................	1,656.65	"
Wallface mountain (top)............................	3,893.18	"
Wallface mountain (foot)...........................	2,367.20	"
Wallface precipice, greatest height................	(1,355.47)	"
Wells Town (Hamilton county) up station.........	1,016.93	"
White pond (Oswegatchie)..........................	1,687.23	"
Whiteface mountain.................................	4,955.09	"
Wilmington Village..................................	1,058.10	"
Wood Hill (Elizabethtown).........................	1,151.60	"

The foregoing altitudes are nearly all based upon barometrical observations generally computed by a direct comparison with the records of the Dudley Observatory only. The final computations by the data of near lower stations, etc., have yet to be made. This work will be commenced as soon as time permits.

Such niceties as the differences of level between neighboring lakes (which are best, or perhaps can only be accurately determined with spirit level), have been avoided in order that time might be had for a more general examination of altitudes of prominent points throughout the whole region—suitable to an extended exploration of its inner recesses. (See also remarks foot of page 86.)

MOUNTAIN PASSES AVAILABLE FOR RAILROADS.

The altitudes of which we have taken barometrically.

The greatest obstacle to the accomplishment of the desire of the inhabitants of the counties of Essex, Clinton, Franklin and St. Lawrence, for direct communication with the southern portion of the State, by rail, has always been the rugged mountain wall of the Adirondack range. Between Saratoga and the counties of Clinton and Franklin exist the chief obstacles; for here, bounded by Lake Champlain on the east and the Raquette river on the west, the mountains attain their greatest altitude, towering to elevations of 4,000 and 5,000 feet, yet severed at different points by deep passes, from which descend north or south the rills which form the loftiest head waters of the great rivers St. Lawrence and Hudson.* Nowhere as yet has railroad penetrated the range, though one or two lines are projected, and I have carefully examined the principal passes in order to estimate their practical availability. These passes through this high mountain section I estimate at eleven in number, commencing at the east, viz.:

First: The Schroon River Pass, through which extends the road from Root's to Elizabethtown; up the main branch of the Schroon, (Hudson water,) and down the main branch of the Boquet. (St. Lawrence water.) The roadway is easy, and the region north and south settled. It is available for railroad use; but has a difficult spot in it at Split Rock where the path suddenly descends northward toward the level of the fertile lowlands of Elizabethtown. Economically, an objection might be urged against it, as too far east and too near Lake Champlain, where it would have to compete with the N. Y. and Canada (or Whitehall and Plattsburgh) R. R. running on a horizontal roadway, while the road through the pass would require heavy grades. It has, however, the great advantage over any pass further west of running through a settled region.

Second: The Hunter's Pass, is at the head of Elk lake, affording a passage through the range between Mt. Dix, and Nipple Top Mountain. The approach from the south is easy, and the ascent gradual till the portals are reached, when it becomes rugged. Height of the centre by my measurement, 3,247.73 feet above tide. This pass affords no additional advantages for a railroad to Elizabethtown; for after a long detour — following the Upland valley of the

*The Canadian Laurentian Mountain range is said to attain only an elevation of 1,200 or 1,500 feet, and the mountains, at the sources of the streams feeding Lake Superior, are said to be of similar inferior altitude, so that we have here in the St. Lawrence a remarkable instance of a great river having its most elevated sources feeding it from one side one-half or two-thirds of the way down its main course.

Boquet downward — the main branch of the defile turns and debouches into the northern part of the Schroon river roadway, above the Split rock obstacle. At the north-west end of the pass valley, a defile communicates by way of Chapel pond with the head of Keene Flats valley, and though the descent is steep, grades might be cut along the mountain sides on the eastern side of the latter valley. I cannot consider this great pass a desirable route for a railroad. Ascending from the west in the short space of half a dozen miles, it rises from 2,052 feet to a height of 3,247 feet above the sea, and descends immediately again, till at the Boquet river crossing — in the Upland valley — it reaches 2,425 feet above tide.

Third: The Elk Pass, in which the principal inlet of Elk Lake has its origin, is the defile next westward of Nipple-top. It leads directly from the head of the stream — the east branch of the Schroon — to a branch of the Ausable; and opens upon the head of the Keene Valley. The ascent to this pass, either north or south, is abrupt; and the summit, by my measurement, 3,302 feet above tide. It is practically unavailable for railroads.

Fourth: The Ausable Pass; is central and important, and only difficult at one point — the Lower Ausable Lake — where Mt. Colvin rises on the east of the gloomy lake, a succession of cliffs, two thousand feet above the water; which is walled upon its western side by Russagonia or Sawtooth Mountain, rising to even a greater altitude. This water-gap is a natural gateway through the mountains. Were the present Adirondack railroad to cross the Upper Hudson at the mouth of the Boreas river, and ascend the latter stream to the ponds of the same name, this pass would be entered by an easy grade, and the road-bed difficulties on the Upper Hudson at *Blue Ledge* would be avoided. From the Boreas ponds to the Ausable lakes the country is level, and a half mile of rock excavation would probably afford a roadway past the lower Ausable lake. It is to be hoped, however, that the wild grandeur of this pass will long remain undesecrated by railroad whistle. The descent northward out to the head of Keene Flats is gradual, and the general maximum altitude for miles through, from the Boreas to the Ausable water is only about 2,000 feet above tide, the descent from the lower lake to the head of Keene Flats — in a distance of about four miles — is only eight hundred feet. This pass is the only one available, midway in the mountains, for railroad purposes. With careful work, and a few dams, a system of slackwater communication could be organized extending from the foot of the lower Ausable lake southward through the pass, and the mountains, perhaps, to the Boreas waters.

Fifth: The Opalescent-head Pass. This is so elevated that I am hardly inclined to consider it worthy of mention as a railroad pass. Its summit is about four thousand feet above the sea, and is broken into numerous subordinate defiles somewhat higher or lower. If we assume the course by the head of John's Brook to be a pass at all, that portion would have an altitude of about 4,600 feet above the sea, and this would nearly connect with the head of the Panther Gorge. There is, however, a lower notch on a branch of the Opalescent river arising amid the ridges of Mount Colden.

Sixth: The Avalanche Lake Pass. This is a cliff walled pass extending through from the Lake Colden branch of the Hudson river

to a branch of Ausable river. The waters of the lake from which it obtains its name wash on either hand the vertical cliff walls of the mountains through which it leads. The height of the centre of the pass above tide level is about 2,900 feet; the descent northward is too rapid to make it desirable.

Seventh: The Caraboo Pass, discovered some years since during this survey is described in another portion of this report, and the origin of its name given. It extends from the Opalescent river waters to a branch of the Ausable. It will prove truly valuable for woodsmen or travelers desiring to cross the range here, as it renders the difficult passage of Avalanche Lake unnecessary. Separating Mt. MacIntyre from the adjoining peak it ascends rather sheerly to an altitude of 3,662 feet above tide and descending still more rapidly northward, it seems to preclude the possibility of railroad building.

Eighth: The Indian Pass (or Adirondack pass) which has been so often described, lies between Mt. MacIntyre and Wallface mountain; it is long, rugged and precipitous at either portal, and has a summit altitude, by my measurement, of 2,937 feet above tide, where the waters divide to the Hudson and St. Lawrence valleys. It is unavailable for railroad purposes unless at enormous expense. From Lake Henderson, which by my measurement is 1,874 feet above tide, the assent northward is constant, and at the southern portal it becomes very abrupt; the mountains also on either side making it impossible to secure a grade without tunnelling. The whole centre of the pass is filled with immense fragments of rock, the debris of the overhanging cliffs; and about four miles from Lake Henderson the summit is reached at a height of 2,937 feet above tide. At the north the descent is hardly less abrupt.

Ninth: The Great Elba Pass, which extends as a broad and extensive valley in the rear or west of Wallface mountain, and forms a pathway wide enough for scores of railroads, becomes contracted at the north into the narrower valley or pass of the head of Chub river; a St. Lawrence headwater. A railroad line once at the Adirondack iron-works would best find its way northward out of that valley—cul-de-sac—by way of the Preston ponds; which are reached by a subordinate pass. This would require a tortuous route, and much expensive rock cutting. I would suggest that for a direct line of rail north from the Tahawus settlement (or Newcomb bridge) that the line proceed north by way of Newcomb lake and Moose pond, on the west side of Mount Santinoni (or Sandanona) and thence northward through the Chub river notch. By this route it is thought that good easy grades and a fair, level country will be found, with the highest summit, in the transit of the pass, not over 2,500 feet above tide.

Tenth: The Ampersand Valley Pass, lying between Ragged mountain and Mount Seymour, offers a route diverging north-westward from the main Elba pass to Ampersand hollow and Ampersand pond, whence the course would lead westward, either along the slopes of Mt. Seward or the Stony Creek mountains, and an entrance upon the lowlands be effected near the Upper Saranac lake. The summit of this pass would be reached eastward of Ampersand pond; which by my measurement is 2,078 feet above tide level. It is practicable for a railroad route, and extends from the waters of Cold river to the Ampersand affluent of the Raquette. It would be more especially useful for a route trending toward Ogdens-

burgh; but for that purpose defiles existing through the subordinate mountain ranges to Long lake, would be more direct.

Eleventh: The Ouluska Pass, which name I originally gave to the whole deep and wild valley between Mount Seward and Wallface mountain, I now confine upon the maps to the single defile which so sharply separates Mount Seward and Ragged mountain alone; and which from its deep and gloomy character is indeed a *place of shadow*. The approaches to this pass — north and south — are even more steep than those of the Indian pass; yet it is not as elevated as either the Elk pass, or the Hunter's pass, being but 3,086 feet above tide. It probably will never be of special value for railroad purposes.

HYDROGRAPHY.

The accurate delineation upon the map of the intricate system of lakes and streams, which form so marked a characteristic of the wilderness, is as difficult as it is important; chains of lakes which forming the natural roadways of the wilderness. The method adopted in this survey has been to determine by angular measurements from the mountain peaks, the inlets and outlets of the lakes, or of great bends in streams when visible from our stations. Wherever the main points of lakes could be thus connected with the triangulation, the subsequent sketching of the form of the lakes was much facilitated; but very frequently the waters are so inclosed by wooded hills as to be invisible from the mountain stations; and other methods are of necessity adopted.

In connection with this lacustrine hydrography, the tracing and mapping of the general course of rivers, with their sources, and the line of divide of waters; the locations favorably situated for slack-water communication; for canals and for great lake reservoirs, with kindred matters influencing or likely to influence these questions, have also, when specially investigated, been noted under the head of hydrography. A glance at the map sketch, illustrating the course of the survey party, will give some idea of the location and connection of the larger lakes of the region, though on too small a scale to show the numerous lesser pools. These waters are actually the most traveled highways of the region; boats being the principal carriages of its few inhabitants; and their chief conveyance in traveling or traffic. I cannot but regard this lake system as one of the great natural wonders of New York. It is this singular water communication which has created a remarkable industry, giving to the State, in its Adirondack guides, a class of faithful men; each guide knowing at least his own portion of the labyrinth; keen in woodcraft; ready at finding trails or marking them; cheerfully laboring; carrying baggage and boats across the portages or "carrys," and leading the wondering novice seemingly by intuition across the wilderness. Were the funds that are squandered on "wild-cat" roads (as the woodsmen call them,) but devoted to the clearing of the river channels, the cutting of paths between the lakes, or the construction of slight dams to hold back sufficient water to cover the rapids upon streams, the facilities of travel would be vastly increased, and the severe labors of the guides lightened. The improvement of some of the more important channels of communication of these public water-highways seems to demand legislative attention; more especially on account of the

extensive and increasing travel across the wilderness by these the only present practicable routes.

To those acquainted with the Adirondacks it is unnecessary to explain the necessity of an accurate mapping of the location of every lake or pond throughout the region; for each new pool or chain of ponds that is made known is but another lane or by-path, and perhaps a greatly needed cross-road, to some other liquid route. Narrative reports have at times been made to me of the discovery of new ponds with remarks like these: "There being no trail, and our only guide "the rough compass bearing of the lake, to which we were to go in "order to continue on the known route; we set out, and, after a long "march, reached a pond answering the description, but could find no "trail leaving it. It being late, camped there that night and on the next "morning descended the outlet about four miles without finding any "other pond as described; which proved to us that we were lost. Got "back to the unknown lake and camped. Next day trailed our way "back out again, and being now out of provisions, had to return east-"ward to the settlements. We think we have found a new lake, and "until it is located and the trail marked, that route will be unsafe and "misleading," etc., etc.

Fully appreciating the importance of the delineation upon the map of even the smallest of these lakes—for the reasons thus explained—I have taken pains to search carefully for them, always noting their approximate position on the preliminary reconnaissance maps, so that in subsequent surveying their positions may be determined. Thus from the surmises and suggestions of the guides, and others, I have been led to important discoveries.

The present deplorable lack of exact knowledge in regard to this region will probably be better appreciated, when I announce that we have now upon our field-books *more than two hundred new lakes or ponds*: new in having never before been placed upon a map. Some have been recently found by the hardy trappers who have come upon them while traversing the remoter sections in search of the wolf, panther or bear. Engaged as my guides, these trappers have led me on to see their own discoveries; and, together, we have afterward found other new waters—some the highest pond sources of rivers—others lonely pools in the deep lowland forest—nearly all of them swarming with monstrous brook trout; and having the marshy portion of their shores stamped by the feet of numberless deer, mingled with the footprints of rarer and more savage animals. Of some of these lakes I have, with aid of prismatic compass and sextant, made reconnaissance maps; some others have been looked upon from the summits of mountains, and others of minor importance have been visited by the assistant or the guides; the position of each, in accordance with its size and value, being as well determined as the time and means at our disposal permitted.

In the specimen of preliminary reconnaissance sketch, exhibiting the sources of the Oswegatchie and Bog rivers there are shown forty-six of these lakes and minor ponds new to maps; (names underlined;) thirty-nine of the most important of which have been well located. Prominent among the new waters are Lost lake, great Gull lake and Oven lake. Of the existence of large lakes thereabouts I had been well assured for five years, and have at last found them. Lost lake,

though shallow, is an interesting pond; great Gull lake, a large and handsome sheet of water—deep and broad—is worthy of comparison with some of the well known lakes of the marginal wilderness. Oven lake is also a large and interesting water, and Cow-horn and Crystal ponds are true to their names: which were given them by the trappers. [In all the different, widely separated sections where these new waters have been found, the trapper's names have been attached to the ponds or lakes which they discovered.]

When it is remembered that persons who are thought to be good authority upon the subject, have stated that there were no more than 460 lakes or ponds in the State of New York, the fact that we here bring forward and first disclose over two hundred additional new lakes — bearing names as explained,— and that there are besides numerous others located on our maps, to which we have as yet been unable to give names; the fact that we now lay before the public a mass of new ponds equal to one-half of the whole number of ponds and lakes supposed to exist within the State—proves how little has been known *accurately* of the vast Adirondack wilderness. The fallacy of statements in regard to the number of lakes existing in the State is probably best appreciated by myself and guides; for we are confident that further search would discover another hundred or more; the whole region being a meshwork of ponds.

Pursuing our researches with all possible diligence we have cross-examined carefully every trapper that claimed to know of new waters; and have only when satisfied of his correctness, taken the time to make a special march to, and reconnaissance of the new lakes. It is important that all the waters — lakes and ponds — should be placed upon the State maps — for once and ever.

A list of the titles of the new waters are hereto annexed. They are located upon the large map which I trust the Legislature will soon order published.

NEWLY MAPPED LAKES.

Alphabetical list of lakes new to the maps of the State of New York, and now located on the Adirondack survey charts by *Verplanck Colvin.*

A.

Addisons pond (R. map, 159).
Allen pond (Grasse river).
*Ampersand pond (little).
Auger pond (St. Law. co.).

B.

Bad-luck ponds (with neighboring nameless ponds, in all ten in number).
Balsam lakes (three).
Balsam pond (Grasse river).
Barsout pond (Oswegatchie).
Beaver pond (A.) west district.
Beaver pond (E.) east district.
Beaver pond (R. map, 21).
Beaver Meadow pond.
Bellafour pond.
Bird pond (lower d.).
Black pond (of Buck brook).
Bord Edwards pond.
Botheration pond (lower d.).
Bromley pond (middle d.).
Brooktrout pond (D.).
Bullhead pond.
Burnt Bridge pond.
Burnt pond (little).

C.

Cage lake (R. map, 161).
Camus pond.
Carl's pond (M.).
Carry pond.
Cat Mountain pond.
Centerbar's pond.
Chandler pond (middle district).
Chase's pond.
Charley pond (little) R. map, 61.
Cherry-patch pond (R. map, 36).
Cherry-patch (little) R. map, 36.
Chub lake (G.).
Cisco lake (Gold brook).
Clear pond (G.).
Colvin lake.
Cold Spring pond (Oswegatchie).
Cook's pond.
Cowhorn pond.
Crystal lake.
Crooked or Elbow lake (new).
Cracker pond.
Cranberry pond (O.).
Crotched lake (little. R. map, 8).
Cub pond.

D.

Darnneedle pond (R. map, 86).
Dawson lake.
Deep pond (Beaver river).
Deer pond.
Dismal pond.
Doc pond.
Dodge pond.
Dry pond.
Duck pond (Oswegatchie).
Dug Mountain lake.

E.

East pond (C.).
Ely lake.
Empty pond.
Evergreen pond (R. map, 135).

F.

Fishpole pond.
Fish pond (O.).
Fish pond (W.).
Fish pond (C.)
Five ponds (five).
Flat-fish pond.
Foster's pond (R. map A., 32).
Frank May's pond.
Frank pond.

G.

Gall pond.
Garett ponds (three) (F.).
Gibbs lake (M.).
Glasby pond (E.).
Grassy pond (O.).
Grasse River ponds (three).
Griggs lake.
GULL LAKE
Gull pond (little).

H.

Halfway ponds.
Halls lake.
Hitchcock pond.
Hitchcock pond (Big.).
Hitchcock pond (little).
Hotwater pond.
Hutchinson pond.
Huntly pond.

I.

Indian pond (W.).
Irish pond.
Iron Mountain pond.
Isley pond.

J.

Jackson pond (w.).
Johny-Mac pond (R. map, 24).

K.

Kibbe pond.
Knowlton pond (R. map, 162).

L.

Lewis pond.
Lem's pond.
Lilly-pad pond (Bog river).
Lizard pond.
Lonely pond (O.).
Long pond (D. C.).
Long pond (Oswegatchie).
Long pond (R. map, 25).
Loon pond (W.).
Lost lake.

M.

Marsh's pond.
Meadow pond (F.).
Middle-branch pond.
Middle-settlement ponds.
Middle pond (Nov., 1873).
Mink pond.
Moose Head pond (G.).
Moose lake (R. map, 23).
Moose pond (F.).
Moss pond or lakelet (E.).
Moxon pond.
Mud-hole pond (O.).
Mud pond (R. map, 36).
Mud pond (smaller, W.).
Mud pond (St. Law.).
Mud pond (C. P. R. map, 26).

N.

Nate's pond (D. C.).
Nine Hole.
Nick's lake.
Nick's pond.

N.

Nick's deer-pond.
North ponds (five).
North-east pond (B.).
North pond (Moose river).
Norway pond (R. map, 156).
Noble's ponds (two).
Number-two-Line-pond.

O.

Olmstead pond (R. map, 159).
Osmore pond (O.).
Otter pond (not of Bog river).
Otter Creek pond (D. S.).
Oven lake (R. map, 148).

P.

Paige pond (R. map, 10).
Parmenter pond (G.).
Partlow lake.
Partlow pond.
Peck's pond.
Pine lake, Big (M.).
Pine lake, little (M.).

R.

Ramsey pond.
Raynor pond (R. map, 94).
Robbins ponds (two).
Robinsons ponds (three) 164.
Rock lake (J. creek).
Rock lake (C. C.).
Rock lake (Oswegatchie).
Rufe's pond.

S.

Sand lake (H.) R. map G., 1.
Sand pond (Moose river).
Siamese ponds (R. 1868).
Silver-leaf pond.
Simon's pond (Oswegatchie).
Sherman pond.
Shingle pond (Elm brook).
Slender pond (Oswegatchie).
Sound (lake).
Speck pond (foot A.).
Spruce grouse pond.
Stony pond (W.).
Streeter's lake.
Sturgess' lake (R. map, G., 5).
Sucker lake (L. R.).
Sweet pond (G.).

T.

Tamarack pond.
Toad pond (Oswegatchie).
Tom Peck's pond.
Thumb pond.
Trout pond ((R. map A., 10).
Tule pond.
Twenty-ninth pond.
Twin-lily ponds (O.).
Twin-pine ponds.

W.

Walker's pond.
Ward's ponds (two).
Wolf lake (R. map A., 12).
Wolf pond.
White Cedar pond.
Whitaker lake (R. map. 1865).
White pond.

Besides other ponds for which even the trappers and hunters have no names.

SOURCES OF THE HUDSON.

Among the waters mentioned in the foregoing list appear the lakelet Tear-of-the-Clouds (or Summit-water) and the Moss-pool, further south, being the two waters which I have designated as the highest pond sources of the Hudson river. In such a lake region as this, where every stream which does not head directly in a pond, if further traced, finally dwindles to a mere rill without definite commencement, the last or uppermost pond upon it is generally accepted as the head and fountain of the river or stream. In this there would appear to be great propriety. The rain which trickles from the crest of the loftiest mountain does not, to my mind, render the transient rills upon that peak the "head waters" of the river. The small spring which near, almost on, the summit of Mt. Marcy permits its surplus water to soak downward, toward the brooks, is not the source; the dank marshes which everywhere are found upon that mountain's sides, sending off slender streams to the foaming Opalescent, are not *the* source. If we make *altitude* the criterion of the river's source, we should look for its head in the loftiest permanent body of water which has a constant and unbroken stream leading downward. The lakelets which I describe, exactly fill these conditions and afford a determinate point, which is tangible and sufficient.

The greater length of one of the upper branches of a stream over the other branches, has often led geographers to claim for it the superiority. In examining into the applicability of this as a rule to the upper Hudson, I have arrived at interesting results.

The following table which I have prepared will give an idea of the approximate comparative length of the various branches, affluents or headwaters of the Hudson. In each, in the first column, the length of the main body of the upper Hudson, intermediate between the mouth of the Sacondaga and the mouth of the stream named, has been included:

BRANCHES OF THE HUDSON.	Full length from source to mouth of the Sacondaga river.	Length of branches separately.
Sacondaga river (two branches)	68 to 75 miles.	About 71⅛ miles.
Schroon river (two branches)	64 to 65¼ miles.	" 58 miles.
Boreas river	62⅛ miles.	" 20 miles.
Jessup's river	85 to 85⅛ miles.	" 35¼ miles.
Cedar river	80¼ miles.	" 29¼ miles.
Cedar river (Rock river branch)	68 miles.	" 14 miles.
Catlin lake branch	74¼ miles.	" 14¼ miles.
Newcomb lake branch	70⅛ miles.	" 7¼ miles.
Indian Pass branch	81⅛ miles.	....
Opalescent river	84 and 85¼ miles.	....

These streams are all properly the head waters of the main body or trunk of the Hudson; each branch having its local name.

A glance at the left hand column in this table will render conspicuous the singular fact, that starting from the mouth of the Sacondaga, and measuring up the Hudson and to the sources of each of the main branches the sum of the distance in each case is very nearly the same.

These affluents form a system of branches, apparently decreasing in length in proportion to the distance from the mouth of the Sacondaga, so that, singular as it may seem, we may acquire an idea of the area of the water-shed of each branch by a knowledge of the distance up the main stream.

Although the names of these branches are local, almost every one of them has had claimed for it the title of the "true Hudson."

The explorations of the State Geologists in the Mount Marcy region in 1836 and 1837, brought the branch, then named the Opalescent river, into notice, as a source peculiarly distant and remarkable for the great altitude attributed to the "mountain meadow" which was claimed to be the source of the river by Prof. Redfield.

If, however, the greatest length of stream, not the volume of water, determines which is the main river, then measurements are apparently as favorable, or more favorable, to Jessups river than the Opalescent.

If the greatest volume of water determines it; it will be impossible to settle the question without comparative measurements of the volume of the different branches during a series of years; for sometimes one and sometimes another branch preponderates, according to the local rain-fall within its area.

If the greatest altitude of water settles the source, then the rills trickling from off the summit of Mount Marcy, and the dripping marshes everywhere upon it are the highest waters — but these are too indefinite to be accepted as the river's sources; and we, therefore, look involuntarily a thousand feet below that summit to where the glimmering pool — Tear-of-the-Clouds — the first collected body of water, affords a tangible beginning.

To my mind, therefore, each upper branch of a river is a source; one, perhaps the longest — another the most elevated; and for the high source of a river, a lake (or a glacier, or a glacier river rushing forth, or an unmistakable volume of water suddenly arising or forming a stream — in a country where no lakes or glaciers exist) would appear to be required to constitute a definite river head.

Upon such grounds, I therefore claim the discovery of the highest lakelet sources of the Hudson. The locations of Lake Tear and the Moss pool are well shown on the reconnaissance map of Mount Marcy.

PRACTICAL CONTINUANCE OF CANALS AND MOBILITY OF HYDRAULIC POWER.

The very important question as to the amount of water available for the supply of the Erie, Champlain and Black River canals has, in view of the contemplated enlargement of one of them for shipping purposes, become more and more important; and my opinion has been requested in regard to the supply which may be obtained from the myriad lakes and streams of the Adirondack region.

In considering this question it seems to me that it is a matter of equal importance to all of these canals. The Erie canal derives more than one-half of its supply from the streams originating in this wilder-

ness, and the Champlain and Black River canals are fed almost entirely by Adirondack waters. The feasibility of the Champlain Ship Canal project depends, absolutely, upon the preservation in reservoirs of the Adirondack supply as a summer reserve for the feeding of that water-way; and the increased facility of transportation by steam on the Erie canal will be fruitless, if the increased waste of water at the locks be not met with an increased supply from its feeders. The system of state canal reservoirs at present existing, such as the "Woodhull" and "Bisby" lakes, etc., will have to be extended upon a vaster scale in every conceivable direction, and this will only be possible in the elevated area of the Adirondack, which, while it affords sufficient head to discharge its water rapidly by gravity, is at the same time so wonderfully blessed with lakes and water-courses. Thus we are brought suddenly to contemplate, with astonishment, the spectacle of a wilderness, agriculturally worthless, becoming the arbiter of Empire; by its wonderful hydraulic facilities and fortunate location granting to the state of New York, to a great extent, the control of the commercial destinies of the great West, the Canadas and of New England.

The amount of water available from the wilderness for each of these canals is nearly equal, and may, by means of skillful engineering, be made extremely equitable in its distribution, in a manner which the peculiar character of the region renders possible, and which — though at first apparently astounding — is actually simple. The barometrical leveling of my survey in showing the altitudes of lakes has developed most important facts. It has been found that the interlocking head-waters of the rivers, flow often, for great distances in opposite directions and at inconsiderable differences of elevation; while the topography of the intervening country after examination of the defiles and ravines, has been found to frequently admit of the construction of connecting canals; so that with aid of carefully arranged dams and reservoirs the water could be made to flow in either direction. Thus a single mind at the Capitol of the state, may control by telegraph the flow of numerous and considerable rivers; and at the tap of the key, turn so many million cublic feet of water from the St. Lawrence to the Mohawk River, the Hudson, or to Lake Champlain! Such a proper system of reservoirs in this commanding position would prevent the stranding of boats in one canal for lack of that water which at the same instant might be swelling in floods through the affluents of the rivers feeding the others — by excess of rains on the distant water-sheds — and would afford to each the quantity to which its commerce and its importance entitle it.

Mention of the more important of these streams whose head-waters thus interlock will therefore be of interest.

[NOTE. — The rainfall for the different watersheds hereafter mentioned has been estimated by the only method available in such a wilderness, without observations for gauging the flow of the rivers and streams, continued during all seasons for many years. The results given are based upon the approximate areas of the watersheds in square miles; an assumed mean rainfall of 40 inches annually, which is even less than the rain gauge would warrant; and the co-efficient 2,323,200. To compute the *mean annual flow* per minute my formula then reads $\frac{40'' \times 2{,}323{,}200 \times \text{area}}{525{,}960}$ = flow per minute in cubic feet. This, however, affords only the *mean yield per minute for the year*. In spring when the streams are filled to overflowing, the mean is of course exceeded; and in summer, or during drought, the flow must be below the mean. To show how great the difference is between low water and high water in the Adirondack streams, Cold river may be made an instance. At the mouth of this river the water in summer may have a mean depth of from eighteen

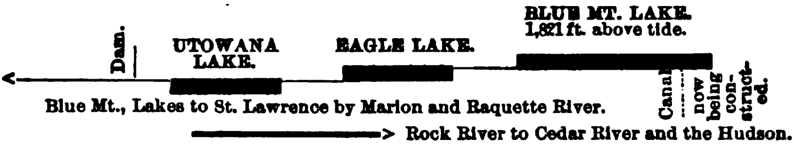
inches to two feet; yet in the season of spring floods the water will reach a depth of ten or twelve feet, and the canoe of the voyageur will float far above the islands and great rocks which in summer overhang the water. It is easily seen that unless all the flow of the year be restrained in reservoirs, the mean flow per minute as computed will not be on hand for use when required, and the volume of the spring freshet will be lost. The great size and capacity of the reservoirs needed now becomes apparent, and also the need of care in their construction to make them secure. This is more important in the case of the reservoirs upon streams descending from the high mountain regions, such as Cold river, the Ausable, the Opalescent, or Upper Hudson, generally. Here the mean annual rainfall far exceeds that of our lowlands and while it may like other mountain regions in some localities even exceed eighty inches, yet it can only be determined by actual observation; and thus the need and importance of a meteorological station with recording rain-gauge in the Mount Marcy region is apparent; and the value of the proposed stone hut or hospice on that peak as such a station, more evident. The rain-gauge here may show us that we have a section possessed of as singular and remarkable a rainfall as the mountainous district of the English lakes (see page 117.) The effect of altitude upon the rainfall has been studied in England with the following results:

Altitude above sea level,	500 feet;	rainfall by gauge,	46.6 inches.
" " "	800 "	" " "	50.5 "
" " "	1,790 "	" " "	52.1 "
" " "	1,750 "	" " "	56.5 "
" " "	1,800 "	" " "	63.1 "

By which the quantity appears to increase with the altitude in rapid proportion. The whole volume of rainfall, however, does not descend to the streams or rivers. Evaporation, especially in a treeless waste — returns a great portion to the air, and this is another proof of the value of forests, whose cool shade moderates this influence. Over farming lands, some estimate the evaporation at one-half of the rainfall. It is variable.]

MARION RIVER and ROCK RIVER. The former is a St. Lawrence water, while the latter appertains to the Hudson. It is mentioned first because even now — all unknown to the public — lumbermen have, I am informed, already at this point for a year or more been draining a portion of the St. Lawrence water to the Hudson. This has come to me through a complaint from the guides, that the diversion of water by a dam on Loon creek, from the lower lake of the Blue Mountain chain has rendered the river below unnavigable; which although in a measure injurious to the water powers of the lower Raquette is of great importance to lumbermen owning timber near Blue Mountain lake; as it enables them to send pine logs to the Hudson, and a good market, instead of the glutted Canadian markets.*

The superficial area of the reservoir — Blue Mountain lake — is undetermined, but cannot be less than 2,500 acres. The profile gives a good idea of the connection of these lakes.



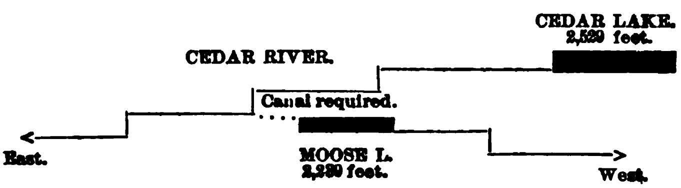
This water-way would be principally valuable to the Hudson side as the Rock river has a very inconsiderable stream. By the structure known as the "34 dam," however, sufficient water is held in it for at least a spring "drive" of logs, and a boom has been constructed above that dam to retain the logs till driving time. The area of water shed thus added to the Hudson must be nearly 6,400 acres, which is equivalent to an annual rainfall of 929,280,000 cubic feet of water. The apparent mean annual flow per minute (at 40") = 1,766 cubic feet. This water would descend to the Glens Fall feeder of the eastern division, for the Champlain canal.

If the East Canada Creek should ever be used as a feeder for the

* The dam on Loon creek having been carried away by a flood, the lumbermen have concluded to construct a new dam, at the outlet of Utowana lake; and a canal from Blue mountain lake itself to Rock river, a distance of about one mile, proposing to flow all three of the lakes as reservoir, and change their outlet through the canal to the Hudson side. I trust, however, that other sources of water supply will be sufficient, and that the beautiful Blue mountain lakes will be preserved from the desolation of flood.

Erie canal—being conducted across the Mohawk by aqueduct—it may be desirable to increase the slender amount of water which it affords, by connecting its head-waters with other streams. Northward of its sources, adjoining Sacondaga lake (of Lake Pleasant) on the west is Little Long lake or Tacalago lake, which flows to the west branch of the Sacondaga river through Peseco lake. It is claimed that during seasons of high water the lowlands between these lakes are submerged, and the waters of Round or Sacondaga lake through Tacalago lake, flow to the Peseco, when it would seem highly probable that by a short canal and dam the water could be further diverted to the East Canada sources; and instead of flowing a hundred miles eastward to the Glens Falls feeder of the Champlain canal, could be made to descend directly to the Mohawk,—though upon the opposite side from the Erie: and *vice versa;* Tacalago lake could be turned into Round or Sacondaga lake; and possibly, Morehouse lake or other ponds at the head of the East Canada could be turned to the south branch of the West river (Sacondaga), but with slight probable advantage to the Champlain canal.

Moose River to Cedar River. In ascending to the sources of Cedar river from the east, I have noticed that the shortest route lies across the Moose lake on the south branch of Moose river. While the outlet of the lake is but a small stream, the numerous affluents entering it below might afford enough water to be of value if diverted into the Cedar river; which their source so nearly approaches; *vice versa:* the head of Cedar river might be turned to Moose Lake; but it is of little volume. Moose lake by our measurement is 2,202 feet above tide.

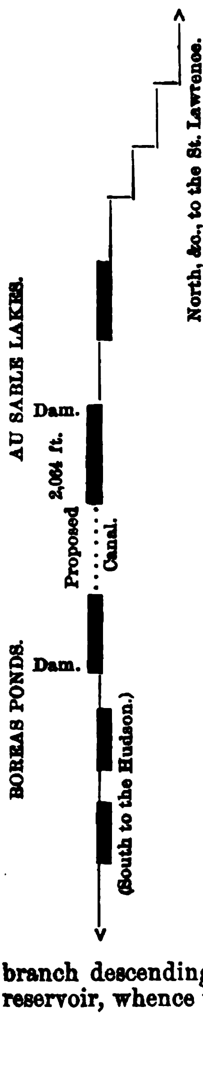


Cedar River to Moose River: The estimated area of the portion of the Cedar river watershed, which might be by dams and a canal diverted to Moose river, is thirty six square miles, or 23,040 acres. This, at 40 inches, indicates an annual rainfall for this area, of 3,345,408,000 cubic feet, and a computed mean annual flow per minute of 6,360 cubic feet. This section is also liable to summer drought; and I have seen the Cedar river in August, near the lakes, almost dry; the flow in spring is, however, very great, and a large amount of water is already kept in reservoir at Wakeley's dam, above Cedar river falls.

The approximate area of the watershed of this branch of Moose river is about six square miles, or 3,840 acres. This area should also, at 40 inches rainfall, afford an annual flow of 557,568,000 cubic feet, which affords an apparent mean annual flow *per minute* of 1,060 cubic feet. Considerable care would, however, have to be exercised to secure such a supply from this quarter, the streams far below Moose lake requiring to be connected by sub-canals, etc. The locality is, in summer, subject to dry weather, which the guides and hunters assert has

become more severe here since the cutting away of the timber on the lower portion of Cedar river.

Cedar River to West Canada Creek. The head-waters of those streams rise so nearly together upon the singular, elevated plateau of this section of the woods, as to suggest that their water might be made interchangeable by canals and reservoir dams. This however can only be determined by special survey. The altitude of Cedar lake by our measurement is 2,529 feet. Should a special survey be made at this point it would be well, at the same time, to examine the closely approaching sources of Jessup's river and a branch of the West Canada, which further south on the plateau may offer facilities for a mobilizing high-reservoir as a feeder to one or the other.



Upper Au Sable Lake to the Boreas Ponds. To this natural water-gap I have before alluded. The constant character of the mountain streams which supply the Au Sable lake make it a valuable source of supply, the only thing, indeed, to be taken into account being the danger of sudden heavy storms on the mountains, which might overtax with their volume an ill-constructed reservoir, and repeat on another field the flood and disaster of which the destruction of State dam on the Lower Au Sable and the sweeping of the valley by the torrent was so horrible an example. This danger should be borne in mind in the construction of all such reservoir dams.

The area of this watershed is not far from sixteen square miles, or 10,240 acres. This, at 40 inches of rainfall, should afford 1,486,848,000 cubic feet annually, indicating a mean annual flow per minute of 2,826 cubic feet. The annexed profile shows the site of the proposed canal.

If, *vice versa*, all the Boreas lakes can be thrown north, a smaller area of watershed would be changed to the Ausable river or about thirteen square miles, (8,320 acres,) the hydrodynamic value of which at 40 inches of annual rainfall is 1,208,064,000 cubic feet, representing a mean annual flow of 2,296 cubic feet per minute. As, in my estimation, the turning of the two lower Boreas lakes northward is quite dubious, and the upper lake is small, the area actually available for the St. Lawrence or Lake Champlain from this source is not great, and, indeed, is not needed.

The Fulton chain of Moose River has been long since specially examined with reference to the canals and found to be available to some extent, and I would suggest, in addition, the possibility of connecting the branch descending from Lake Fonda or Sumner, with the Woodhull reservoir, whence it would descend to the Erie canal.

The Canal Department records afford the following statistics for this system of lakes, which were surveyed for the purpose of ascertaining whether they afforded sufficient water to replenish Black river and replace the supply diverted to the Erie canal:

LAKES OF THE FULTON CHAIN, ETC.	Acres.	Above tide.
Moose Lake	1,060	1,772 feet.
First "	406	1,684 "
Second "	175	1,684 "
Third "	166	1,684 "
Fourth "	1,979	1,687 "
Fifth "	9	1,691 "
Sixth "	58	1,760 "
Seventh "	1,609	1,762 "
Eighth "	809	1,776 "

Besides these there are the

WOODHULL RESERVOIR LAKES, ETC.	Acres.	Above tide.
Woodhull Lake	1,236	1,854 feet.
Chub "	530	1,509 "
South Branch Lake	518	2,019 "
North Branch "	423	1,821 "
Sand Lake	old. 98.70 } 345	1,798 "
Mud "	23.02 }	1,799 "
Bisby " (3d)	....	2,016 "
Jock's "	About 1,200	2,188 "

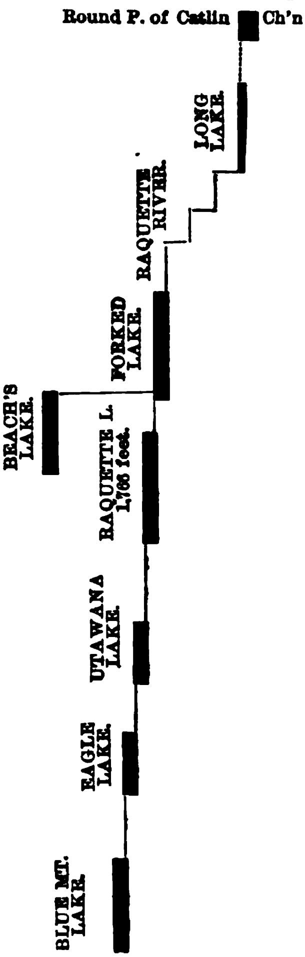
Including the north and south branches, and to the mouth of the south branch, the area of this portion of the Moose river watershed, is nearly 197 square miles, or 126,080 acres. This area, at 40 inches depth of annual rainfall, should have an annual flow of 18,306,816,000 cubic feet of water, or as computed, a mean annual flow per minute of 34,806 cubic feet.

Long Lake and Raquette River, into the Hudson. This project, which originated over thirty years ago, seems to have been the only spot at which the *mobility* of the hydraulic power of the region has been thought of. If we accept the survey of that period, Long lake at high water is so elevated, that by a dam at its outlet and a canal to Round pond, the water could be diverted to the head of the Catlin lake chain, and could, therefore, in fact be led directly into the Hudson.

So sure were the projectors of this contemplated improvement, of the accuracy of their views, that a canal was commenced for lumber purposes, the slight excavation and embankment for a long distance still continuing visible.* This work it is said was suspended on account of the opposition which arose on the St. Lawrence side of the divide, far down within the settlements; the objection being skillfully taken that the proposed canal was merely for private benefit, for a few lumbermen, and not for public purposes, and therefore not covered by the laws granting the waters to the canals.

Accepting the survey made at that period, though believing that a very lofty dam would be required to flow the waters of Long lake to Round pond and the Hudson, it leads to interesting results.

The Raquette, from Schedd lake to some distance below Long lake, has a valley which interposes between the sources of Moose, Beaver and Oswegatchie rivers, and the Hudson sources, and if Long lake could not be itself diverted to the Hudson it would prevent any portion of the water of those streams from being turned eastward, unless conveyed across Long lake by aqueduct. I find by the dubious records, apparently in 1772, of one of the ancient surveys that there is even written testimony that Long lake — called "the wide river"—did at one time empty into the Hudson by the same general course, though not the same channel through which it was afterward proposed to divert it. When it assumed its present course, if it ever had other, we cannot tell; but by an early map of Totten and Crossfield's purchase, the lake is shown unmistakably as the Hudson river, traversing northwardly through the twenty-first and twenty-second townships, turning eastward in the fiftieth, and descending as the Hudson still, through the valley of Catlin lake! This may have been one of the many errors of judgment of the explorers of that period arising from not following the outlet of Long lake far enough; but if we traverse the course which they delineated, we shall perhaps descend from Long lake to Cold river, then up the latter stream to the head of its lower stillwater, when turning south we have before us a low alluvial country; which seems almost to warrant the idea that the river actually ran to Catlin lake, at some time during the post tertiary period.

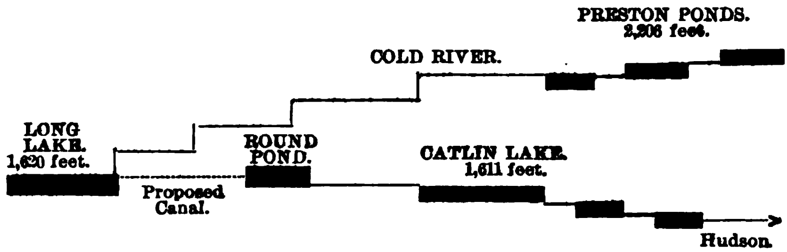


In looking at this section from the summit of Mt. Seward, however, I have felt in doubt in regard to the possibility of flow-

*It is not however much larger than some farm ditches.

ing Raquette water to Round pond; the very aspect of the country making it improbable; and deeply regret the accident to the instruments which prevented our executing a test level. If the facts are, as represented, [it is said that at high-water in Long lake its water is but four feet below the level of Round Pond], and it becomes advisable, to divert Long lake to the Hudson, it would be well to locate the dam some distance below the lake so as to secure the water of Cold river, which at times is of greater volume than the main Raquette itself; and in fact has by strangers been mistaken for the Raquette. This would add the Preston ponds to the number of new lakes in the system of reservoirs for the Hudson; and it may here be remarked that the topography of the region south of Cold river seems to admit of the direct conducting of the upper portion of Cold river, and the drainage of the Preston ponds to the Catlin lake chain; though at great expense; and even to Newcomb lake with Moose pond, by aqueduct, though black spruce ridge might prove impenetrable.

The plan of connection of this section would be as indicated by the annexed profile figure.



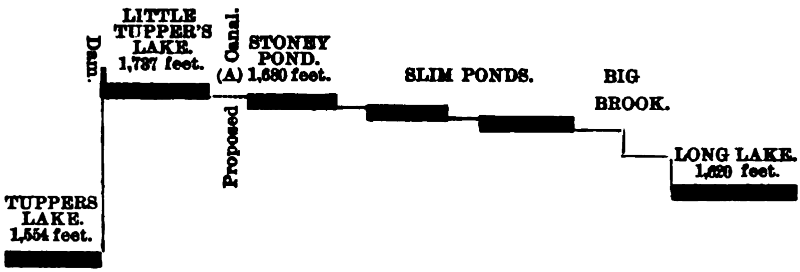
It will be seen by an inspection of this profile that the turning of Long lake into the Catlin chain is problematical. Indeed the question cannot be determined without a special survey. The importance of the question — the largeness of the area of water-shed involved — renders this very desirable.

The Cold river branch from the Preston ponds, etc., has a water-shed of an area of about 72 square miles or 48,080 acres, and at the low rate of 40 inches annual rainfall, has a drainage of 6,692,816,000 cubic feet of water a year. This would indicate a mean annual flow of 12,721 cubic feet a minute. But as it is in the mountain region it may be double that, as 40 inches is barely half of what might be expected from the known heavy spring and autumn rainfall.

The approximate area of this portion of Raquette river water-shed, feeding Long lake, (from Blue mountain, Beach's lake, etc., etc.,) is about 230 square miles or 147,200 acres. Assuming a mean annual rainfall of 40 inches, computation affords an annual total rainfall for the whole area of 21,373,440,000 cubic feet of water, representing a mean annual flow per minute of 40,637 cubic feet.

Admitting that this connection with the Hudson is here feasible, it opens the way to numerous other of the more westerly streams, where the topography and levels taken, suggest the possibility of sending the waters of still more elevated lakes, across trifling divides, by canal, to the affluents of Long lake, and so to the Hudson.

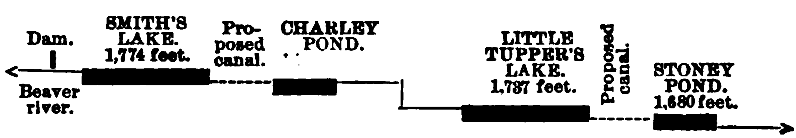
Little Tupper's Lake to Long Lake. By constructing a dam at the outlet of the Round pond, at the head of Little Tupper lake stream, or outlet, a reservoir of water having a flowline of from eighteen to twenty miles long and four or five miles wide, might be made, and as the barometrical measurement indicates that Stoney pond, at the head of Big Brook, (descending to Long lake) is sufficiently below Little Tupper's lake to admit of the draining of the water that way, it seems to be a valuable source of supply. The profile shows the proposed course of drainage.



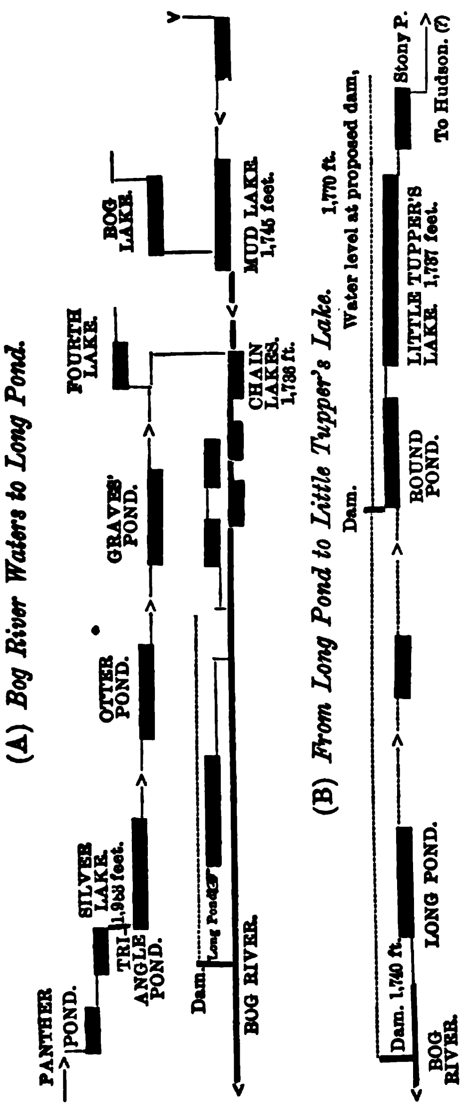
Little Tupper's lake is six miles long and somewhat shallow. The shores are low and often sandy, but it is fed by inlets from a dozen or more smaller lakes and ponds. It drains a water-shed of nearly 50 square miles or 32,000 acres, and on the uniform estimation of 40 inches annual rainfall, would afford 4,646,400,000 cubic feet annually, or a mean annual flow per minute of 8,834 cubic feet. There would be very little rock cutting for canal, the soil of the divide being sandy, but there is no clay for puddling of dams, etc. This channel was suggested in my previous report.

Beaver River (Smith's Lake, etc.) to Little Tupper's Lake. This would, of course, tend to the Hudson. A dam at the outlet of Smith's lake would form a reservoir fed by half a dozen minor lakes and ponds. At the north-eastern portion of Smith's lake, in what is known as Snell's bay, enters a very small rill from the direction of Charlie pond, a small lake which is upon the other side of the divide, and flows to Little Tuppers lake. The ground is irregular and broken between the lakes; but to the north of the trail as approaching Charlie pond it lies lower, and appears to offer a pass which can be made available without very great cutting. It should, however, be specially reconnoitered. The area of water-shed thus opened toward the Hudson would be approximately 34 square miles, or 21,760 acres. The rainfall by the same rule as before used, should, therefore, be annually, 3,159,552,000 cubic feet, or a mean annual flow per minute of 6,007 cubic feet.

The profile will show how it is supposed the waters can be here connected. The length of canal required would be nearly two miles.



It would probably require some heavy rock cutting and excavation, for the canal here suggested. The section is the more interesting because the Harrington pond inlet of Bog river has a branch which extends so far north-westward that it might be possible to connect it with some of the newly-discovered lakes in the Oswegatchie region, near Partlow lake, etc., which waters would, collectively, be of value, and increase the annual *volume* of water.



Bog river (*Mud Lake, etc.*), *to Little Tupper's lake.* From a mountain which commands a view of the valley of Bog river, I have seen indications of passes or low gaps amid the hills to the east and south of the saddle-bag shaped "Long pond," which lies to the south of Bog river. An examination of the levels and of the localities along the river where a suitable dam could be made, tends to prove the possibility of this. At several points below where the Long pond stream joins Bog river, the steep banks on either side of the river are so near and high, that by a suitable structure (for which there is both timber and stone at hand) the water could be raised and held so as to flood all the immense area of marshes at the head of the river, and in all probability set it back into Long pond, whence it would seem that it might, by canals and dams, be conducted to the Round pond of Little Tupper's lake, as shown by the accompanying diagram.

From Long Pond to Little Tupper's Lake. The water in Little Tupper's lake by our measurement is somewhat higher than the present level of the Chain lakes of Bog river, but the rigid enclosure of Bog river by the hills below the chain, as before mentioned, makes it possible to raise the water even twenty or thirty feet if necessary, which would appear to be all that is required, unless the divide is more elevated than it seems; or

upon the raising of the water, some small gap opening westward to the Oswegatchie headwaters, should lead the water that way. In that case another dam would be necessary, and then an additional convertible reservoir would be had, whose waters could be discharged either to the St. Lawrence or the Hudson. The Lost lake (shown on plate 11) seems to be the point at which this result might be expected. The area of the actual water-shed is about 45 square miles or 28,800 acres; by the same allowance as heretofore (40 inches), it should furnish an annual rainfall of 4,181,760,000 cubic feet; being an apparent mean flow of 7,950 cubic feet per minute, annually. Over twenty-five lakes and ponds pour their water to this portion of Bog river, and by their availability as reservoirs for the retention of the heavy freshets of spring and autumn, would aid in keeping up the flow, per minute, near the estimated amount.

Besides the reservoirs thus suggested, there are many minor points where water communications could be made; and it is clear that with telegraphic connection with the gatekeepers at the reservoirs, water-gates could be thrown open or closed at any point, at any instant, and waters either sent in torrents to the Champlain canal, or rushing through their old channels supply the demand of Erie, or Black river commerce.

Already the value of these waters has been appreciated by the mill owners of the St. Lawrence county and the Oswegatchie. Grasse river and Raquette river reservoirs, upon the St. Lawrence side, retain great volumes of water. Upon the Hudson side of the divide, similar but less extensive reservoirs, such as those of Lake Henderson, Indian lake, and Wakely, on Cedar river, have been constructed. These last are lumbermen's reservoirs, intended to secure the necessary amount of water for "driving" or floating lumber down toward the settlements. The reservoirs of lumbermen, however, are almost valueless to the State canals, for the water is restrained and kept back in the season of drought when keels of boats are scraping the beds of the canals, and is released in flood volume at autumn or spring when streams are running full. If sufficient reservoirs were constructed at the numerous favorable localities upon the Hudson side of the divide alone, and the water conducted from them gradually, as required during the season of drought, and this holding back of the water in summer prevented, there would be no grounding of boats in the Champlain canal at least, and a similar course could not fail to be equally beneficial to the other canals. *In case of the construction of such reservoirs, the greatest care should be taken to make them secure and firm, as in season of freshet they would be subjected to immense strain.* They should be constructed in a permanent manner, and stone should be used for dams, facings, retaining walls, etc.; and is everywhere abundant upon the very sites where it is required.

The whole system of management of reservoirs for lumbering purposes is diametrically opposed to the interests of the canals and of the lowlands, as they are simply organized deluges, the water being retained in the reservoirs only for the purpose of driving the logs down toward the settlements when it is released. This is one of the causes of the singular and unexpected freshets on the Hudson which

suddenly in spring or fall make their appearance, flowing docks, and causing merchants hurriedly to hoist their merchandise to the upper stories of their buildings.

It seems to me that the wasteful treatment of the waters demands the attention of our canal authorities, and prompt action, even though it should involve the purchase of the water privileges and of the lumber lands. It is, indeed, another practical argument in favor of the proposed Adirondack park.

TABULAR STATEMENT*

Of the approximate values of the principal water-sheds, referred to in the foregoing pages.

WATER-SHED OF	Can be diverted to (ultimately)	Area of water-shed in sq. miles.	Area in acres.	Computed annual rainfall at forty inches, in cubic feet.	Computed mean flow per minute.
Marion River Head	Rock R. and Hud.,	10	6,400	920,280,000	1,766.8
Moose R. Head, small South Branch and Lake...........	Cedar and Hudson	6	3,840	557,568,000	1,060.0
Cedar River Head	St. Lawrence	36	23,040	3,345,408,000	6,360.5
West Canada Creek Head....	Cedar R.? and Hud.	24	15,360	2,230,272,000	4,240.3
Upper Au Sable Lake	Hudson......	16	10,240	1,486,848,000	2,826.9
Boreas Lakes	St. Lawrence?	13	8,320	1,208,064,000	2,296.8
Fulton Chain Lakes to mouth of S. branch of Moose R...	Erie Can. and Hud.	197	126,080	18,306,816,000	34,806.4
Long Lake, *feeders* .... }	Hudson and Cham- }	230	147,200	21,373,440,000	40,637.0
Cold River .... }	plain Canal...... }	72	46,080	6,690,816,000	12,721.1
Last two together..........	....	302	193,280	28,064,256,000	53,358.1
Or, with Moose Creek........	....	318	203,520	29,553,104,000	56,193.8
Little Tupper's Lake.........	....	50	32,000	4,646,400,000	8,834.1
Smith's Lake..................	....	34	21,760	3,156,552,000	6,007.2
Bog River, etc.................	....	45	28,800	4,181,760,000	7,950.7
Upper Hudson (above N. C'k)	....	645	412,800	59,938,560,000	113,960.0

*The volumes before given, as has been heretofore explained, are approximations based upon the areas of the different water-sheds in square miles, by the formula given. In midsummer the flow per minute is far below the mean for the year, and I should estimate, as a minimum, 1-5th or 1-6th of the quantities in the last, right hand column of the last preceding table. Thus, the mean flow per minute at the middle of August of any year would amount at 1-5th of the mean annual flow to the following quantities:

SECTION.	Flow per minute in cubic ft.	SECTION.	Flow per minute in cubic ft.
Marion River Head	3[illegible]8.36	Long Lake Outlet	8,127.40
Moose River "	212.00	Cold River	2,544.23
Cedar River "	672.10	Last two together.............	10,671.63
W. Canada Creek Head...........	848.06	And Moose Creek	11,239.76
Upper Ausable "	565.38	Little Tupper's Lake	1,766.83
Boreas Lakes, etc.....	459.36	Bog River Head	1,590.14
Fulton Chain, etc.	6,961.28	Smith's Lake, etc........	1,201.44
Upper Hudson (above N. C'k)	22,792.00		

These would be about the quantities available at midsummer in case the spring flow should not be retained in reservoirs.

The area of water-shed of the Upper Hudson, and of all its affluents above North Creek, may be estimated at six hundred and forty-five square miles, or 412,800 acres. At forty inches annual rainfall, this should afford annually 59,938,560,000 cubic feet of water, or 448,370,460,000 gallons; and a computed mean flow per minute of 113,960 cubic feet, or 852,480 gallons. Allowing, as heretofore, one-fifth of these quantities as the available flow at midsummer, or in season of drought, the Hudson, above North Creek, at its lowest stage, has an unaided natural flow (without reservoirs) of 22,792 cubic feet (170, 498 gallons) per minute. Of the 448,000,000,000 cubic feet of water which descend upon this water shed, an unusually large proportion reaches the streams. In a fully cleared and cultivated region, one-half of the rain fall may return to the clouds by evaporation, but in these dense and cool forests evaporation is greatly modified.

The leaks in the cavernous limestone rock above Glens Falls, so often referred to by the Canal Commissioners, will explain why all this water is not available at that point.

In view of the importance of these waters to the State canals, and the only partial control which, despite the laws, the authorities have over them, it would seem very desirable to vest in the State, as soon as may be, the title to all these wild lands, in order to secure the unrestrained use of their waters.

Upon the proposed Adirondack park or State forest, also depends much of the value of the great aqueduct for the cities of the Hudson river valley, which I proposed and explained in my previous report; for, unless the region be preserved essentially in its present wilderness condition, the ruthless burning and destruction of the forests will slowly, year after year, creep onward after the lumberman, and vast areas of naked rock, arid sand and gravel will alone remain to receive the bounty of the clouds — unable to retain it. The rocks warmed by the summer sun will, like the heated pot stones that serve the savage to boil his food in kettle of bark, throw back the rain as vapor; and the streams that now are icy cold, in the shadows of the dark, damp woods, will flow, exposed to the sun, heated and impure.

The location which I before selected for the erection of the dam across the Hudson, for the reservoir and head of the proposed acqueduct still seems to me the best. Above where the Schroon river or east branch joins the upper Hudson, there are many localities well situated for the construction of a dam for feeder.

While the Schroon is loaded with the refuse of the tanneries of Warrensburgh and the drainage of the fields of a portion of the settled region, the main Hudson, if it should be taken above North Creek, would be free from any such defilement. The west shore of the river, which is followed by the Adirondack railroad, is well situated for the construction of the aqueduct, and but little broken by streams or ravines. A high stone-bridge aqueduct would be required at the mouth of the Sacondaga river, and though it might have to be 200 feet above the river, it is possible to construct it with a single arch. From this point the course would be along the foot hills of the Kayaderoseras range in Saratoga county; and from a sub-reservoir amid the hills, a branch could diverge to Saratoga, affording a powerful supply for that place. Thence the great aqueduct could be led to the plateau

south of the Mohawk, and crossing, upon arches, the Hudson between Albany and Troy, would afford a pure supply by gravity for both those cities. The remainder of its course, if continued to New York, would be simple, especially if a supply by gravity should not there be a desideratum, for in that case it would be merely necessary to construct a closed aqueduct tube along the line of the Hudson River railroad to the city. The supply by gravity is, however, on the score of final economy and completeness, preferable wherever possible; but before the project can be taken up, the question of the value of the water-power rights which would be affected by the diversion of the stream, must be considered. As far as the canals are concerned, the power and right to take the water is unquestioned; it remains to be determined whether this is a *property vested in the State*, or only a privilege of the State. If a property, it can of course be granted by legislative act to a city or company as a grant of the "surplus waters of the canal feeders," etc.

If this source of city supply be regarded as at present too expensive, and recourse be had to pumping of river water contaminated with sewage, the public health will demand a revolution in the system of the drainage of our cities. The whole front of a city draining to a river, will have to be faced with a gigantic main sewer, into which all the old drains of the city empty, leading the sewage along the city front to some point beyond its suburbs, where a huge basin would receive its contents. In this manner the millions of money, which Victor Hugo claims are thrown annually into the sea — a waste of agricultural fertilization — might be preserved. But the difficulties of such a scheme are even greater than those involved in the construction of the proposed aqueduct; which would afford to the Hudson river valley pure water without the vast expense of granite river embankments, and of the vast arched sewers, that would eventually be required to preserve the health of the cities deriving their supply from a polluted river. The cost of the aqueduct, if extended to New York, would not be far from $55,000,000; estimating the work of the character and cost of the Croton aqueduct. The portion between Albany and the head reservoir, say at North Creek, is about seventy miles; a great part of which might be left with advantage, open to the air; and might, perhaps, be constructed for $9,000,000.

The importance of a pure and vast supply of water fresh from the mountain springs, rushing by its own weight, uninterruptedly and continuously downward, will at some time be appreciated and these suggestions may then be of value.*

In regard to the hydrodynamic influence of forests in this Adirondack region, there is nothing occult or difficult of comprehension. The rainfall of a mountain region, so near the sea-coast, almost always exceeds that of the lowlands, more especially so when the mountain region is a region of lakes. Of the effect of altitude we learn from Loomis that "on the island of Guadaloupe, in lat. 16°, near the summit of a mountain of 5,000 feet elevation, the fall of rain in 1828 was 292 inches, while near the base of the mountain the fall was only 127 inches;" also, that "along the western coast of Hindostan 'runs a range of mountains whose summits are deluged with rain, while 'near their western base the amount of rain is by no means extraordi-

* For first mention of this project see Proceedings of Albany Institute 1872, p. 305; and also report on this survey, 1872.

"nary, and on the eastern side of the fall is less than one-third of the "average for the same altitude. At Bombay, on the western side of the "mountain, the average annual fall of rain is 78 inches; at the eleva- "tion of 4,500 feet the average fall is 254 inches, and in 1842 the fall "amounted to 305 inches; while at Poonah, on the eastern side of the "mountain, the average fall is only 23 inches."

But this effect of altitude is not confined to India; for in England, the beautiful lake region of Cumberland, has during some years received a rainfall of 180 to 240 inches; which is equivalent to a mass of water 15 to 20 feet in depth! This is the more remarkable, because at the same time in the neighboring lowlands, the rainfall did not amount to more than 40 or 60 inches.

Now, as we have at Albany an annual rainfall of from 30 to 50 inches we may feel sure that in the Adirondack region, amid mountains, ranging from 3,000 to 5,000 feet above tide, where I have known it to rain furiously ten days in succession, the rainfall is greatly in excess of the indications near tide level.

The question, however, is, "do the forests cause this extraordinary precipitation of moisture?" and in answer it may be said that, though we are unable to tell how far they influence it, it is evident that their coolness, dampness and resistance to evaporation are very powerful. The coolness of the evergreen forests in summer, condenses to vapor or cloud and rain the warm, moist southern breezes. The moist, mossy, peaty soil receives the fresh rain, and readily permits it to pass down into the cavities amid the rocks. The dense forest spreads above all, and, sheltering moss and earth from the sun's heat, prevents evaporation. In spring, moreover, it shields the accumulated snow of winter from the sun's direct rays, and prevents it from rushing suddenly off in furious floods; which, if the whole area of our northern woods were laid bare to the heat, instead of merely breaking up the ice in the Hudson, would rush down, making the upper valley of our river one broad gutter of ruin.

Such is the simple way in which the forest exerts its more potent influences. If the importance of its preservation shall come to be fully understood, the people of the Hudson valley, navigators and others, will demand its permanent reservation as a security against spring freshets; as the water, if more slowly forming from the snow, could be secured in reservoirs and serve at midsummer to replenish the river and canals.

It is my opinion that the severity of the annual vernal freshets in the Hudson can even be much mitigated, and the now not unusual winter-breaking of the ice, perhaps, entirely avoided. At various points in the forest, the places of vast fires of former years are now marked by thousands and thousands of acres of wide and desolate barrens, worthless to man and gloomy to the sight; yet once heavily covered with valuable timber. The burnt region on the Boreas river and upper Hudson alone covers an area of from 40,000 to 60,000 acres of rolling, semi-mountainous lands; desolate with burnt, blackened logs; ghastly, barkless, dead timber — standing — and a partial undergrowth of worthless birch, aspen and alder brush. This whole section

is deeply covered with snow in winter. Exposed to the direct rays of the sun, the snow is affected by the first thaw, rapidly converted into wet slush, and if the thaw continues, descends suddenly to the river in torrents, breaking up the ice.

Where the forests have been preserved, the snows are little affected, and remain in deep banks even till June upon the open ground in the woods. In the Indian Pass, indeed, season after season, I have found the snow and ice of the previous winter lying amid the rocks in July, August and September — and even when fresh snow was commencing to fall.

At different times I have carefully examined these burnt lands, and have come to the conclusion that they could be profitably replanted with white pine trees. There are here and there patches of sandy and gravelly soil amid the Boreas river mountains, and in the lowlands the gneiss rock is often covered with this drift deposit, which, though almost sterile for farming purposes, would serve as soil for the planting of a new evergreen forest, that would shelter the snows from the sun These lands are at present valueless and unproductive, alike to the pseudo owners who allow them to be sold for taxes, and to the State, which derives no revenue from them. They can be cheaply and easily replanted with valuable varieties of timber from seed or with young trees, as is done in Germany by the professional government foresters. But the life of the individual is too short to permit him to contemplate the planting of such a forest. The man who plants the pine will, in all probability, be dead when it is fit to be cut, and the State alone, which lives forever, would reap the benefit of his labors. It is the State, therefore, which should undertake this great work; and I would suggest that in the event of the creation of a forest preserve or park, the donation of these thousands of acres of burnt lands, which some of the owners have assured me they would gladly give to the State, be accepted, and that a trial be then made of the planting of from one to ten thousand acres with white pine cones, for I feel sure that in ten years the people would be astonished at the result. Enterprise is an American characteristic, and in our early days was characterized by tree destruction; now, in the preservation of forests we must learn from Europe that economy which experience has dictated.

Here, under the shade of the young trees, the forest moss would grow again, and soon these vast areas of arid and burnt rocks, would be covered with fresh loam; while, growing thriftily, the larger trees, would suddenly present themselves as a cheap supply of valuable lumber. Thus a new forest would be created and prevent the melting of the winter snows, and the sudden floods; and, by its conservation of moisture and condensing coolness, would at the same time moderate droughts, and benefit navigation. Then in the place of untaxable lands these barrens would become a source of great income to the State.

All these matters have been kept in view during the progress of the survey; and the locations suitable for water communication between lakes, for the erection of reservoirs, with the place of ponds and marshes diminished or dried up by the cutting away of the forests, and other notes of hydro-dynamic interest from time to time made, have frequently been sketched in upon the maps.

BOUNDARIES.

In all the denser portions or "cores" of the wilderness, the locations of the division lines of lands, are in such doubt as to lead to great confusion; often, indeed, to contention, in those sections which are accessible to the lumberman, and from which valuable varieties of timber are taken by the various lumber companies, and floated out down the streams to settlements.

County and town lines, so elegantly laid out upon paper, are often impossible to find, and such tracts of lands as change hands between lumbermen and speculators, are generally of necessity known and described as "township No. —— in —— tract, 'patent' or 'purchase.'" Such reference is either to the great grants of lands made by Colonial government under authority of the Crown of Great Britain previously to the revolution, in the then "colony of New York," or to the immense tracts given away at a nominal price by our commonwealth shortly after it became a State.

The surveys of these great patents were imperfectly made with aid of small magnetic compass and chain; and according to the tradition of backwoodsmen at times with a rope for chain. At that period the question of magnetic declination was little understood, and there are few if any local records of the variation. Attempts at its estimation now, (for the earlier instances, at least,) are little better than guess-work.

Local attraction was also neglected, and, indeed, the surveyors of the period, owing to their limited knowledge of the many changes in magnetic variation, secular, diurnal or accidental, noted in their field books only the most extraordinary perturbations — the reversing or sudden change of bearing of the needle by beds of loadstone or iron ore which they approached — and then plunged blindly on, near towering mountains, great forest trees, and beds of rock containing grains of magnetic iron disseminated; all of which exercised their influence upon the needle. The rudeness of the methods in use at that time for chaining the distances over mountainous ground, did not fail to add to the error, so that in place of the horizontal and straight or right-lines intended, the old boundaries are often wavering in some degree, or bent or diverging from the intended course. These divergences have, it is claimed, in various spots left intervening strips of land — known as gores — belonging to neither of the adjoining tracts. The boundary surveys of these tracts were never, in any sense, topographical surveys, they were simply compass lines marked on trees; and almost all the topography which appears upon the present county

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maps has been obtained subsequently; often on no better foundation than the casual statement of a traveler who has visited the region.

Notwithstanding these errors, (which in so vast an area are not easily discovered,) these ancient survey lines continue to this day to be the principal reliance of landowners, and they are everywhere the dividing line between property. Nevertheless, as they were only lines of blazed or axe-marked trees, it is often impossible to find any indications of their presence; for besides the crumbling decay of a century, wind-falls and forest fires have swept over in places, and forever extinguished them.

The failings of compass and chain are surpassed by the failings of the line itself, which, when marked upon poor trees, vanish soon with the fall and decay of the monumental timber. In these damp, mossy forests, rank with decay, it seems little else than mockery to have selected such crumbling monuments as the field books of some of these early surveys record. A "stake" or "heap of wood," even though surrounded with "witness trees with long blazes," may be difficult of identification after the lapse of a century; yet are the actual recorded marks of the corner of a township in a portion of the wilderness, full of "stakes" and "heaps of wood" and "long blazes" on the trees, long ago made by trappers, for trail or trap-boxing, and after such a lengthened period, often difficult to distinguish from surveyors' marks. It is only when the permanent topography and landmarks of the country enter into these field books that they become of lasting value to posterity; and it is to be regretted that only in a few instances, has the Colonial surveyor been at the pains to measure the distance from his township corner, to the shore of some lake near by. Generally, the mountains and lakes are so little shown that one would never suspect their existence; and, indeed, running only on the sides of the huge townships, without venturing into their interior, the old surveyors were really unacquainted with the interior. So great has been the influence of these old land patents, and the great estates which they represented, in moulding and forming the political divisions of the northern portion of our State, that the lines of division between them have been, to a great extent, adopted as the county lines; and, with a few local exceptions, the lines thus obtained are still the most accurate and reliable.

Of the whole extent of the county boundaries (lines) within the wilderness region, these old lines form over seventy-one per cent ($\frac{71}{100}$) by a careful calculation which I have made; and besides occurring in the town lines, they form almost the only other boundaries between estates.

The great *Totten and Crossfield purchase* forms by its northern limit parts of the northern boundaries of three counties, Essex, Hamilton and Herkimer; affording at the same time, practically or supposedly, the southern limit of both portions of the "*Old Military Tract*," and of a portion of "*Macomb's Great Purchase*." The division line between the old military tract and the eastern part of Macomb's purchase, is also the division between a portion of Essex and Franklin counties; and the boundaries of the Lawrence, Vrooman, Artherburgh, Nobleborough, and other tracts, at the south side of the woods, form, in a similar manner, the boundaries of other counties. In fact, so intimately are these old patents connected with the county organiza-

tions, that their names and titles have become the cognomens of the vast areas of the wilderness wherein they are located, and are, therefore, the *local names* for great sections of the region embraced under this survey, and as the popular titles of topographical areas, demand recognition.

Their relative areas and positions are so imperfectly understood by the general public, which have no access to the old records and documents, that I have endeavored to briefly outline their characteristics, as their importance will admit, in the appendix. (See Appendix B.) In the accompanying sketch, in colors, showing the location of these great land patents, I have brought together, upon one sheet, the several tracts as though perfectly contiguous, omitting to show thereon the gores that are claimed to exist. The relations of these patents to each other, and to the several counties, will be more readily comprehended, while the slight sketch of topography forming the groundwork, will give an idea within which of the tracts, well-known localities are situated.

At different times I have made careful search for these corners in order to connect them with my work, but with indifferent success. When searching for the marked trees it is necessary to keep an eye upon the dead and fallen timber, and often after long and painful search we find, prostrate and moss-covered, the dubious, crumbling remnant of a tree, that should be the landmark between millions of acres, but which here, in the dampness and gloom of the dense wilderness forest, lies decaying. There can hardly be a better proof than this of the great value of the permanent mountain landmarks, whose positions and bearings it has been my labor to locate. I am, however, convinced that by a long and special search some of the great corners of these ancient patents can be accurately found; and well located; and it is to be hoped that immediate steps will be taken by the State, for the permanent establishment of from eight to ten of these great corners, before the last witness tree has rotted to the ground.

Though this would require several years of special work, it would be simply the performance of a duty which the State owes to land owners, for whom the surveys (for which they paid the State) were originally imperfectly executed, and left without the permanent corner marks, to which the extent and value of their purchases entitled them.

In my searches for county corners, also, the same state of affairs has been apparent, often probably, because these pre-revolutionary lines were accepted as the boundaries. In order to prevent endless litigation, incumbering our courts, it will be also necessary to fix and establish by stone monuments, the different county corners within the wilderness. Unless this be done the lines of the counties will become uncertain, and in time extinct.

All the counties of northern New York will be equally affected and the interests of the State itself are at stake; for it seems to me very doubtful, in many cases where lands in this region have been sold for taxes, whether proper descriptions of the property have been made, many lots which are thought to be in one town or county, being actually in another.

I have endeavored at many points to locate these interior corners by triangulation from the mountain peaks, but so rugged and mountainous is the whole of this region, that wherever it has been possible

to find a corner the mountain stations were invisible, and that method of work therefore was inapplicable. The corners are generally in deep valleys or upon one side of some mountain range, and so inclosed by the mountain ridges, that it would require the chopping away of timber and the clearing of space, equal to a small farm at each corner, before it could be surely ascertained to be accessible to location, by angular measurement.

The best method of determining these hidden corners would be by astronomical observations with zenith sector, (or altitude and azimuth instrument,) in conjunction with siderial clock and chronograph; telegraphic connection being maintained by a portable (military) telegraph line connecting with a proper observatory, such as the Dudley at Albany. This would afford the astronomical co-ordinates of each station with accuracy, and these records would in themselves be equal in efficacy and permanency to the stone monuments of native rock, which would be firmly set to form enduring and incontrovertible corner marks to these great counties, for countless ages.

In case this should be undertaken, as it ought to be, I would urge that—

(1.) Wherever practicable the permanent corner-mark or center should be made in the bed rock; which may almost invariably be found at or near the surface of the ground in the mountains. It would be advisable to sink a drill two or three feet vertically into the rock, and fill the hole with steel scraps and lead, in order to form a station mark which could not be destroyed without great labor.

(2.) The telegraphic connection in determination of longitude should be insured by insulated copper wire of good size. Such a wire, properly covered, could be used on any ground, and laid cable-like along or across the bed of a lake.

COUNTY LINES.

The counties of New York in some respects stand in the same relation to the State that the territories of the Union do to the United States. The Senate and Assembly of the State can by law change the boundaries of the counties, establish new lines of division and alter or modify the local form of government; which the national legislature can only constitutionally do with the territories. As the United States thus legally determines and establishes by survey the boundaries of its territories, so it would seem that the State is bound to legally determine and survey the lines of its several counties.

In Great Britain this right of the counties has been fully comprehended, and the British Ordinance Survey maps have become the guides of the assessor.

Such a survey of the county lines in this State has never been made, and it is to this omission of natural duty that the quarrels and disputes in regard to lines of division, and the proper description of lands sold for taxes, are attributable.

The origin of this fault, if we accept the traditions of the State land office, is very simple. At the close of the revolutionary war in 1782, the new State just arising from the embers of seven years of war was moneyless. Rich in its vast areas of wild lands, yet without the means to have them surveyed, it was suggested and adopted, that the

public lands be laid out *upon paper* and sold, in order that the treasury might be in some measure replenished without the expense of survey. The system of office surveying, on paper, became very prosperous, and though occasionally leading to sales of one million acres at an estimation of eight hundred thousand, suited all parties, and was continued till the State was thought to be stripped of its last acre; and all boundaries were necessarily left in an execrable condition of rambling and conflicting compass lines, by the hasty local surveys made for different owners. Later came new counties, created also upon paper by legislative enactment, bounded principally in the Adirondack region by the limits of the heterogeneously associated tracts; the mere private tree marks of individual owners!

It is difficult to realize such a state of affairs; and the search for these private lines which were accepted as the county lines, reveals the most surprising errors. The condition of the St. Lawrence county line has been heretofore alluded to, and is well shown by the illustrations (plate 13), but it has been found that in some places there are not now and probably never were any county lines whatever. At the south-eastern corner of Franklin county close search has failed to discover any county line, and the line of Essex county, for many miles, is discernible only upon the maps; vast tracts of land being inferentially, either in one county or another; truly comforting information to those who desire to dodge taxation. This south-eastern corner of Franklin county has also been searched for vainly; and the whole affair is but an example, showing the imperative necessity of the State, now in its wealth and power, executing the county surveys; which it could not do in the days of its poverty, following the revolution.

The same remarks may in some measure, be applied to all the counties of the State; and the interests of the land owners, the great body politic, demand the accurate survey of all the counties; not for the purpose of reducing or changing the crooked lines to straight ones, but for the measurement of the crooks and turns *accurately* as they exist, in order that the true area of the State may be determined, and of the counties and of private lands as they are; and that correct data may be at length obtained, for a perfect map of the State.

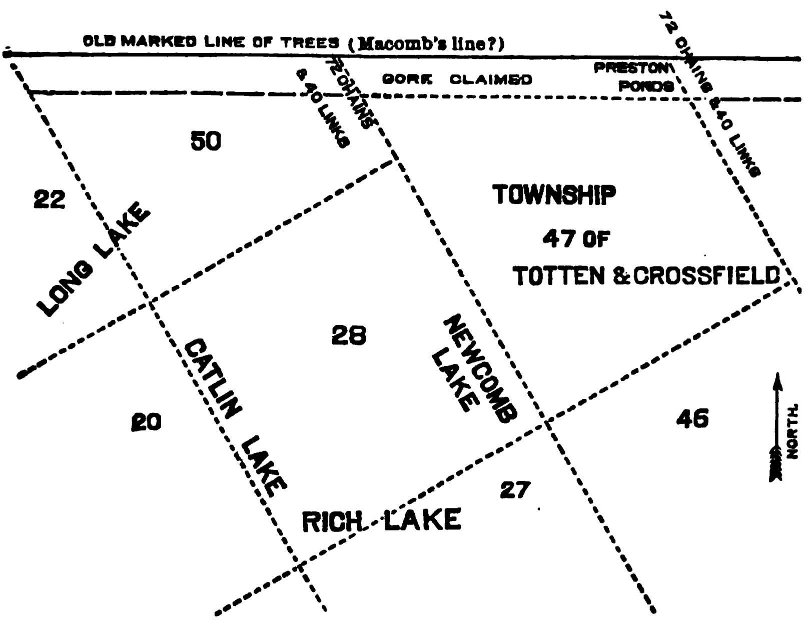
GORES.

Of the great number of gores which are claimed to exist through inaccurate surveys, I have space only to refer to one which is claimed between the north line of the Totten and Crossfield purchase and the south line of Macomb's great purchase. It is traditional that a "gore" exists between these purchases, and much research has been made in order to ascertain whether it existed, and if so, where? By the laws of the State the division lines as found are accepted as evidence, as against lines of bearing or distances recorded on paper.

It was assumed by the legal authorities of the time, that the south line of the Macomb and the north line of the Totten and Crossfield purchase as I have shown it upon the map sketch in colors, was one and the same, and with the belief that this was the fact, they made this assumed single line, the southern boundary of St. Lawrence and Franklin counties, and the northern limit of Hamilton, etc.

It is claimed that they (the authorities) were mistaken, and that there were two lines, and between them a *gore* separating the counties. Certain parties desirous of securing the valuable timber, pine and spruce, which grew on what they thought was a portion of this gore — lowland timber accessible to water — investigated the subject, and concluded that the gore was a narrow band or strip over half a mile wide, having parallel sides and extending east and west along within the present claimed limit of the Totten and Crossfield purchase, of which they believed it never formed piece or part. These parties obtained a quitclaim deed from the State (through the Commissioners of the Land Office) of so much of this gore as lay within the Township No. 47 of the Totten and Crossfield purchase, as they claimed, improperly. The tract of which they thus possessed themselves included the Preston ponds at the head of Cold river, and was of the form shown by the accompanying diagram.

MACOMB'S PURCHASE.



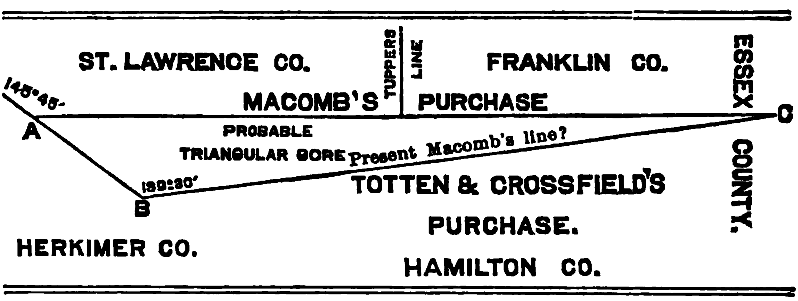
It will be seen by examining the figure, that the gore claimed had parallel sides, and along its diagonals at either end had a claimed width of 72 chains and 40 links, and included the Preston ponds. The foundation upon which this claim for a gore here rested, was that the northern boundary of the Totten and Crossfield purchase, was a line running west from a point ten miles north of Crown Point as the compass needle pointed in 1772. The claimants of the gore held that this line actually passed to the south of the accepted or old line some 72 chains and 40 links, as shown in the figure by the dotted line.

They caused a survey to be made, commencing at Crown Point, and measuring north ten miles on the ice. From the corner thus made they produced a line westward to the neighborhood of the Preston ponds; and claimed that this line was the true one,* and that it came south of the old marked line — which they called the Macomb line — and alleged that the existence of their gore was thus proved. Their claim was disputed by those holding, previously possession of these timber lands, who claimed that no such gore existed, etc., etc.

Entirely disinterested in this matter, I desire to call attention to certain facts which seem noteworthy; and which, while they may tend to indicate that a gore exists, would locate it differently, and show for it a different form and vaster area, and attribute its origin to different causes.

The gore claimed at township 47 was south of the old line and included the Preston ponds. It seems to me that there is as good evidence that the gore lies entirely to the north of the old marked line, and that it does not contain the Preston ponds; and that it is a *great triangle* instead of a parallelogram. Examining the records of the two surveys, I find old maps and measurements which may be accepted as data. Upon the old map of Macomb's purchase at the north-west corner of Totten and Crossfield, is shown the great obtuse angle formed by the two lines at the south-west (B), linking the Gt. tracts No. 1, 2 and 3. This obtuse angle measured on the map 145° 25′. From the records of the measurements made by the surveyors of Macomb, the angle is also given and is 145° 45.′ It is evidently 145° and 25′ or 45′. If we take the same angle to-day at the true N. W. corner of Totten and Crossfield, we find it on the best authority 139° 30′, and on another almost equally good, 139° and 30′ also. These are evidently not the same corners; for there is a difference of at least six degrees (6°) between them.

The corner of 139° is apparently to the south of the 145° corner; and if they were accurately measured in accordance with the rules of trigonometry there remains a triangle of the following form.



By a trigonometrical computation we obtain the inclosed inner angles A, B, and C of the triangle, and

The inclosed angle at A=	34° 15′
The inclosed angle at B=	139° 30′
The inclosed angle at C=	6° 15′

* See boundaries of Totten and Crossfield purchase, as given in appendix B.

Such a triangle would contain from 159,040 to 172,800 acres, in accordance with the length of base adopted. The reasons which in my opinion render so large and wide a triangle improbable are numerous; but we may, nevertheless, let it stand as one of the indications of such a shaped gore.

2d. Examining the matter from another standpoint we arrive at somewhat similar conclusions, at least as to the existence of a triangular gore. The marking out on the trees of Macomb's great purchase, was made by long lines on the magnetic meridians; and according to the map of Macomb's purchase, these lines were produced from points on the parallel of N. lat. 45° to the north line of the Totten and Crossfield purchase. The surveyors who chained these long meridinal lines, recorded the distances, which we will take as data in connection with other and more recent material.

The distance from latitude 44° N. to latitude 45° N., it is to be remembered, is about 69·0359 statute miles.

The north-western corner of Totten and Crossfield's purchase is 3·250 miles due north of latitude 44° N.

The northern line of Totten and Crossfield, at the point where Tupper's line is supposed to strike it, is 6.125 miles north of N. latitude 44°.

The distance along the parallel from one to the other of these offsets is about 28 miles.

The length of Tupper's line was 63·125 miles. It was the line adopted as the division between St. Lawrence and Franklin counties.

Also the length of west line of the Old Military tract, as measured, 60·125 miles.

Tupper's magnetic line appears to vary considerably more than the bearing and year would seem to authorize. If we allow 2° 22′ 20″ for the azimuth, which his line should make with the meridian, we find it insufficient, for 5° 35′ west appears to be more nearly the present actual declination of this line from the meridian, at least at one point.

Running the distance which Tupper records (63·125 miles) at an angle of 5° 30′, we have a

Departure =	60 miles =	5.75 and Lat. =	59.72
	3 miles =	0.29	2.99
	.125 miles =	.12	.01
	Depart.	6.16 miles; Lat.	62.72 miles.

Then 62·720 statute miles is the length of arc of the meridian between latitude 45° and the south end of Tupper's line; and as this south end is 6.125 miles north of latitude 44°, the two added should give the length of the one degree of the meridian in statute miles (= 69·0359 miles), whereas it is only 68.845 miles, differing (.1909) nearly one-fifth of a mile, 1,056 feet at that point. This, supposing the triangular gore previously shown to exist, would be the midway width of the gore. I have grave doubts, however, as to whether Tupper did actually measure even the 63.125 miles as claimed. Every curve that he made in his line, and every mountain over which he passed, without carefully leveling up his chain, gave him an apparent distance

without a right line length. There is, therefore, a probability of a wider gore than the last computation shows. In the distance of 28 miles along the parallel of 44°, also, there is a difference between the length of the two offsets of 2·875 miles.

3d. The most striking proof of the existence of a triangular gore, allowing the written boundaries to be the legal boundaries, is obtained by a careful examination of the question of the north boundary of Totten and Crossfield's purchase, as defined in their deed. In this discussion, however, the first thing to be determined is, what was the magnetic declination (variation) in 1772, at the time of the survey; all the lines being magnetic. It must also be kept in mind that the surveyor is here dealing with spherical lines, that he is working upon the spherical surface of the globe, which, though in short lines imperceptible, renders his distances considerable arcs of the earth's circumference.

Measuring accurately upon the map, a distance ten miles north of Crown Point, along the magnetic meridian of 1772, turning a right angle at the termination of this line and producing a line westward properly, it is found to run to the north of the Macomb south line (as that line is accepted) and constantly widening as it goes west, leaves south of it a triangular gore, which though more narrow, has the form of the triangular gore first shown. In attempting to place the form of this apparent gore upon paper I have noticed certain peculiarities which suggest to me the origin of such gores. The line trends too much to the south and in a proportion which seems to indicate that the surveyor in running the line, if it ever was run for Totten and Crossfield and their associates (?), did not take into account the convergency of his sight line toward the equator, or that he was not aware that it is impossible to run a parallel of latitude by due east or west lines of sight without corrections for this convergency. To put it more plainly, he did not seem aware that while he could start accurately east or west from a station, he could not advance by long sights without running either south-west or south-east.

Assuming that the distance to be run for the northern boundary of T. and C. purchase was 80 miles from place of beginning, I have computed the convergence as follows: Near latitude 44° N., then in running six miles we should have a convergence to allow for of 46·266 feet. Now, to find the total convergence for the distance, we have the proportion, as 6^2 miles : convergence in 6 miles :: square of distance : x. Converted into links our problem would read; 2,304,000,000 : 70·1 :: 409,600,000,000 : x.

It is readily computed as follows:

$$\frac{409,600,000,000 \times 70\cdot 1}{6^2 \text{ miles}} = 12462\cdot 22$$

Then the completed proportion reads in links 2,304,000,000 : 70·1 :: 409,600,000,000 : 12462·22 + and the answer 12462·22 = 6231·11 links being the convergence in 80 miles for lat. 44°. This is equivalent in feet to 4,112$\frac{53}{100}$ feet, which is less than one-half of what the graphical delineation would show.

All this tends to suggest that a vast gore of land actually exists in the position which I have indicated, but the preceding remarks are merely intended to show how dubious and uncertain are the boundaries, and areas of lands within this region, for its existence can only be proved by a special survey. The area of the apparent gore varies with each form or basis from which it is deduced, the most moderate of the preceding estimates indicating at least 25,000 acres of land, while it might be figured even higher and actually have a much larger size. It may not be uninteresting to remark that while the Macomb corner was a maple tree, the Totten & Crossfield corner was a spruce tree; another point in which they disagree.

If this gore exists it is the property of the State; wild lands, forest covered and never granted, sold or donated, so far as we know, since the world first emerged from chaos. The primeval forest here has been so far, except in patches near lakes and streams, untouched by the axe, and the accessible portions may rate for their timber, as high as five dollars an acre. Should the gore, therefore, prove to exist as indicated, so differently from all previous surmises and conclusions, the ancient tradition is justified; and I am afforded the pleasure of turning over to the State a little kingdom of land, which at five dollars an acre would be worth $125,000.

It is advisable to determine by re-survey the exact condition of these lines, and it is to be hoped that we shall have in this gore the nucleus for the Adirondack park, obtained without expense to the State.*

I trust, therefore, that the Commissioners of the Land Office will so comprehend the interests of the State in this matter, that they will refuse to grant other quitclaim deeds, either of gores which do not exist, or of gores which do exist, and are so much cash in the treasury of the State.

* *Late Note.* — Should the indications prove, on re-survey, correct, and the area amount to 25,000 acres, there would be over 100,000 acres of wilderness lands in the possession of the State which could be converted to the purposes of the Adirondack park. I have been favored by the Deputy Comptroller with the following schedule of lands now owned by the State within the region.

Counties.	Part.	Acres.
Clinton	Old Military Tract	19,136
Essex	Westerly part	14,538
Franklin	All parts	3,692
Hamilton	All parts	39,629
Herkimer	Town of Wilmurt	1,867
St. Lawrence	Macomb's Purchase	....
Warren	North-western Towns	5,553
Total of lands now owned by the State in this wilderness		84,415

TRIANGULATION.

At the conclusion of work in 1872, more than half of the most important of the true Adirondack mountains had been occupied with the theodolite, as trigonometrical stations, and the general, relative angular position of these great peaks had been found; while numerous lesser angles had been measured to minor stations. Commencing near Crown Point, where measurements were made to stations at the shore of Lake Champlain, the triangulation had been advanced westward with the intention of securing the interior work before the season in the mountains should become too inclement and wintry. As stated in the report of 1872, it would be necessary to measure a few additional angles in order to perfect the connection with Lake Champlain, and the known objects or datums adopted as the basis of the work.

As such datums, at the resumption of work in 1873, I had selected, as heretofore mentioned, the principal light-houses at the lake shore; the position of which, and their distances, etc., having been determined both astronomically and geodetically, with great accuracy, by the United States Coast Survey, rendered them, with aid of the data courteously furnished me by the officials of the survey, entirely sufficient for the purposes of this trigonometrical reconnaissance. My thanks are specially due to Prof. J. E. Hilgard, assistant in charge, for directions given the draftsman whom I employed at Washington in copying numerous maps of the shore line of Lake Champlain from the archives of the Coast Survey.

I have already, in the preceding narrative of field work, given an account of the character and location of the base-lines adopted and of our difficulties and final triumphant measurement of the primary triangles nearly in the desired locations. These locations I had selected as peculiarly favorable for the rapid and accurate connection of the Coast Survey work with our interior stations, and it was my design to make each distance between the light-houses, the base-line of an entirely distinct triangulation — the one base to the north, the other to the south — so that in each determination of an angular point, (for instance, a mountain peak,) we should have results based on entirely independent data; which, if agreeing, would be a proof of accuracy in each. Thus error in measurement would be liable to be detected at its origin, before it should prove too late to remedy it; and this check would serve, in some measure, as a base of verification in case it should finally prove to be impossible to measure one in the tangled recesses of the wilderness. As detailed in the narrative, we were favored, later in

the season, by the Coast Survey, with information of the location of two of their carefully measured base-lines, and with the astronomical coördinates of their principal Lake Champlain stations; with the latitudes, longitudes and azimuths.

I had contemplated an interior base line of verification to be measured upon the ice of Long Lake in winter, and had arranged to make angular measurements from the mountain peaks in summer, to signals at stations marked in the rock near the water-level on the lake. It would then have been comparatively easy to have measured the base upon the ice in winter; but the completion of the angular measurements was delayed by a week of storm in the field, which so hindered us, that the requirements of my plan of work — the number of days allotted for the purpose — were even exceeded in exasperating delay; till other appointed work imperatively demanded attention.

The selection of light-houses, well-known and almost permanent land-marks, was the more advantageous as the height of their towers was sufficient to secure the requisite elevation above the earth and disturbed lower strata of the atmosphere; a matter of much importance in measurement along lines of eight or ten miles length, in which the combined curvature of the earth and refraction would subtend a vertical difference of from 35 to 60 feet, from the right line.

Our chief signal, the automatic stanhelio, has been heretofore fully described. It has been employed in preference to mirror or silvered tube signals, as being more substantial; glassware being almost infallibly broken in carrying in a wilderness. Our special form is preferred to the well-known tin cone signals, etc., for the reason that it is visible at distances many times greater than the cones; and it is believed that if constructed of equivalent plates, of sufficient thickness, of steel or copper, nickel plated and polished, it will resist the tarnishing influence of the weather, and by its constant brilliancy overcome the only objection to the tin signal. When hung upon an axis so that its vibrations would be in the plane of the meridian — the approximate azimuth of the station being taken into account with the hour of the day and the declination of the sun — a correction for *phase* could be applied, and it would then supply the great desideratum in geodetical surveying, a cheap and reliable signal for long distances, and one which would not require the attendance of a signal man, and yet be always in adjustment unless destroyed.

Two large boxes of tin for automatic stanhelio signals of different sizes, were purchased and put in the hands of the express to be forwarded to Long Lake. They, however, never reached their destination, remaining it seems at North Creek station, at the head of the Adirondack railroad.

In noticing the preliminary work of the triangulation, I must deplore the form of construction of the domes of the light-houses. They might have been made without any additional expense, so that the surveying transit or theodolite could be set upon the very summit and centered. Their acute form, however, has prevented this, and rendered a reduction to center necessary in the measurements taken from the towers, materially increasing the labor in the trigonometrical computations. The same fault is to be found with the towers and domes of almost all great public buildings; which in a survey must

be accurately determined, and would from their commanding character be almost invaluable if not indispensable, yet cannot be occupied on account of their unfortunate construction.

In a line of well-located light-houses this mal-construction is the more to be deplored, for the reason that they afford most valuable and unchangeable datums for reference of different surveyors, who, proceeding to the same stations, and repeating the same measurements made previously by others, can discover the true location of lost stations in state or local surveys. I trust that this will be borne in mind in the construction of the tower of the new Capitol at Albany, so that in case of the trigonometrical survey of the State, which must ultimately be made, the surveyor may be able to center his theodolite at the center of its tower and from this height, the proper center of triangulation, radiate lines in all directions without local obstacle to interfere.

The station marks, copper bolts sunk in the rock, have been heretofore described They serve admirably, and would last forever if undisturbed. In one instance, however, some malicious person has chiseled away the rock and stolen the bolt; though other secret station marks will enable me to refind the station center. In the future it will be advisable to drill a deeper hole in the rock, and fill it with molten lead, with which scrap steel or handsfull of small nails could be advantageously mixed to prevent its being readily drilled out by individuals, who, for the purpose of creating confusion or frauds in lands, might hereafter desire to destroy the corner. If the expense should not be considered too great, a larger hole could be cut with churn drill and an iron tube fitted with hinging lid, to keep out dust, etc.,which would enable the surveyor to erect, at any time, a mast for signal standard, or to take it down and center his instrument accurately over the spot where it had stood. This would be of great value on commanding rock crests, where it would otherwise be almost impossible to erect a signal or secure an accurate center. Under the furious hurricanes which sometimes sweep the mountain peaks, the very stones are thrown from the summit and any unsubstantial tripod of poles blown away like a feather. The signal notice (card) used at the later trigonometrical stations has also been heretofore figured and explained.

COPPER BOLT STATION MARK.

The Geodetical Field Books used during the past season were of better form than those previously employed, being more compact and less bulky. They were made in accordance with the form which I had found by experience to be the best, and by commencing the record of a measurement on the left hand page and running on over to the next, the records in no place run over a leaf, but each line and set are complete wherever the field book is opened. Thus the field book is made of less width, while having more room for titles and figures. The following is the form for the left hand page:

[Left hand page.]

On Graves Mountain. (W. Theodolite.) Mean Results.

No.	STATIONS OBSERVED TO.	Approximate Distance.	Magnetic Bearing.
1	Mount Marcy (zero).........................	known.	S. 81° 41′ E.
2	Mount Emmons (station B.)..................	known.	S. 88° 35′ E.
3	Pond (A.) lower end	1½ miles.	Compute
4	Pond (A.) upper end	1¾ "	by arc.
5	A spruce covered peak (D. of map)...........	3 "	"

The column for approximate distances is new in such field books, but is very useful where small, nameless, forest-covered hills near by have been observed upon in measurement, and with aid of this and the letters of reference in the reconnaissance sketch the topographer when platting the angles can have no question as to which summit is referred to. After taking several magnetic bearings at the most favorable time, the remainder are left to be computed from the triangulation.

The form upon the other page, extending on to the right, is here shown.

[Right hand page.]

V. C. Observer. [Station marked by Copper bolt, No. 15.]

HORIZONTAL LIMB.				VERTICAL LIMB.		REMARKS, SIGNAL, &c.
Vernier A.	Vernier B.	Mean.	R. or L.	Vernier.	A. or B.	
00° 00′ 00″	180° 00′ 00″	....	....	0° 39′ 00″	A.	On station S. end.
42° 54′ 40″	55° 00″	54′ 50″	R.	30′ 30″	A.	On signal (Stanhelio.) Bright phase.
86° 40′ 00″	40′ 00″	40′ 00″	L.	1° 34′ 00″	B.	
58° 00′ 00″	00′ 00″	00′ 00″	R.	....	B.	Sand point.
153° 01′ 00″	01′ 00″	00′ 00″	R.	12′ 00″	B.	Peak.

On this page are always recorded the measurements — horizontal and vertical — in degrees, minutes, and seconds of arc, much as above shown. The trigonometrical measurements during the past season are contained in two volumes of the preceding form, and are the records of the work at the different stations mentioned in the narrative. A sufficient list of the more prominent mountain peaks occupied as stations has been given in the preliminary portion of the report (page 13), with the station marks and numbers by which they are distinguished.

At different points, however, in the progress of the angular work, important peaks, rising even to altitudes above 4,000 feet, have been found, to maps hitherto unnamed and unlocated. It became necessary to give to each of these some title by which it might be known upon the field books, and referred to in measurements. Wherever the Indians, guides or hunters had names for such peaks, even though grotesque, I have adopted them; and, indeed, in all the nomenclature of the region all important popular names have been adhered to, even when taste would have led to a change—excepting only in the case of Mud Pond at the head of the Schroon which, in order to distinguish it from the numerous other mud ponds, we have called Elk Lake, in memory of the stately alcine deer once abundant in the vicinity.

The titles, Mt. Marcy, Mt. Seward and Mt. Dix, were given years ago by the State Geologists to the peaks which now bear those names. The first two were named after Governors William L. Marcy and Wm. H. Seward, and the third after the then Secretary of State and present Governor John A. Dix. The titles of Mounts Marcy and Seward, though generally accepted, are objected to by many who prefer the names which the aborigines are said to have given them—*Ta-ha-wus*, "cleaver of the clouds," and *Ou-kor-lah*, or the "great eye."

It seems appropriate, however, that we should have among our mountains, such majestic monuments to those who have so often received the public trust, and in that manner give a peculiar and historical character to our geography. For this reason I have given to three other peaks the names of three other Governors.

Upon the range of which Mt. MacIntyre is the highest crest are two other lofty peaks, that we have only hitherto been able to distinguish as *north* and *south* MacIntyre. To the south peak I have given the name of Mount Clinton, after a governor who was, perhaps, the first to fully appreciate the value to the canals, of the rivers descending from this region; and to whose interest in science, and sagacity and public spirit in early days, the State is deeply indebted. This grand peak exceeds 4,000 feet in altitude, and its height will be finally computed from my trigonometrical measurements. To the peak next north of Mt. MacIntyre I have given the name of Mount Wright, after Governor Silas Wright, who was indeed a representative of this northern region, and whose own St. Lawrence county may be looked upon from the summit of this vast granite monument. Its altitude cannot be far from 4,000 feet above the sea.

Directly opposite the frowning crest of Mount Seward arises another haughty mountain, amid numerous lesser peaks, yet all nameless, though the crest has nearly an altitude of 4,000 feet. This we have the gratification of first placing upon a map, and I have given this summit the title of Mount Seymour, after a governor who, in his early days, was an explorer, summer and winter, of portions of this wilderness, and whose name is pleasantly remembered by old guides.

To the loftiest peak of the Jay range in Essex county I have given the name of Mount Mac Donough, after the gallant officer whose victory upon Lake Champlain was witnessed by this mountain. Seen south from Plattsburgh it presents a majestic summit, and rises to a greater height than Mt. Hurricane, which lies about a dozen miles to the south in the same general range.

The peak which I have named, Mt. Redfield, lies to the south and west of Mt. Skylight, as shown on the reconnaissance map (plate 6). It is named in honor of William C. Redfield, whose services to science have been so various and valuable, and who was also one of the earliest explorers of this region. It is he who first described Mt. Marcy, calling it the "High Peak of Essex," and by his energy and enthusiasm, the first expedition to the summit was organized. It was he who claimed the Opalescent river to be the true head of the Hudson — and passing the streams which descended from Lake Tear without discovering it — held that the loftiest source of the Hudson river was in the mountain meadow or marsh — from which the left hand branch descends—which however is itself fed by the still more elevated meadows or marshes of each terrace upon the slopes of Marcy. While we are compelled to turn to Lake Tear as the definite spot which we may term the highest pond source, the labors of Prof. Redfield seem to me to demand the recognition which I have given them in the mountain so near the scenes of those early explorations. It is remarkable that like Mts. Haystack and Skylight, this peak should have so long escaped notice, though possessing an altitude of 4,688 feet above tide.

The location of the other new mountains will be shown upon the final map, and it may here be stated that in addition to those discovered and named in the report of last year, and those just mentioned, there are others full as worthy of names, but as yet only known on our maps by letters and figures.

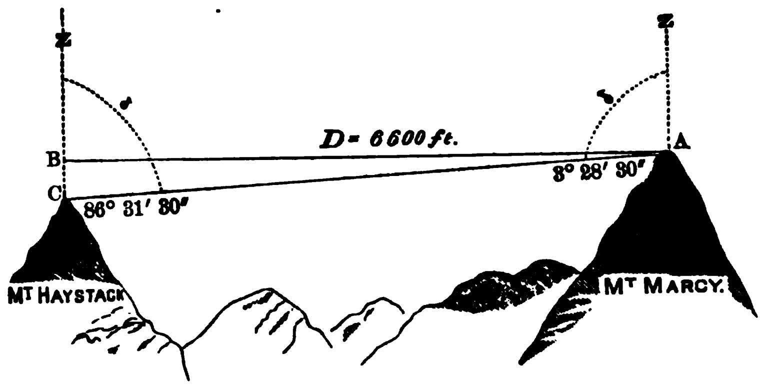
Notwithstanding the rapidity of the reconnaissance, vertical angles have been measured to and from most of these great peaks, and the distances being short, the angles often large and the refraction estimable, they have been employed as a check upon the barometrical determinations of altitude—more especially in settling the differences of height between neighboring peaks. An interesting example of one of the comparisons of height is shown by the determination of the difference of height between Mt. Marcy and Mt. Haystack. The mean height of these stations by barometrical measurement is as follows:

Mt. Marcy........................	5,402.65 feet.
Mt. Haystack.....................	5,006.08 "
Δ =	396.57 "

My measurement of Mt. Haystack — first ever made — had proved it to be the THIRD MOUNTAIN HEIGHT OF THE STATE; and by barometer apparently 5,006 feet above tide level. So narrow was the margin by which this mountain attained, or seemed to attain, an altitude of 5,000 feet, that a careful test by some other method appeared desirable. Assuming Mt. Marcy as the datum, the difference of height could be determined with great accuracy.

To test the question of difference of altitude I computed ~~it~~ trigonometrically, with interesting results. The conditions of the problem are best understood by an examination of the figure.

FIG.



PANTHER
GORGE.

The distance (D) between the mountain peaks here shown, as determined by triangulation, is 6,600 feet.† The difference of height between peaks (A to B being a line of true level) of course equals B C. The zenith of each station is shown by Z and Z′, but as the measurements were by reciprocal vertical angles taken on each peak the side B C can be easily computed (correcting the observed angles for refraction,) * as follows:

$$\sin C : \sin A :: AB : BC$$

Then we obtain —

$$\sin C\ (86^\circ\ 31'\ 30'') = \log.\quad 9.999201$$
$$\sin A\ (3^\circ\ 28'\ 30'') = \log.\quad 8.782565$$
$$A\ B\ (6{,}600) = \log.\quad 3.819544$$

Using Co. Ar. of C (0·000799) we have the log. of B C = 2.602908 and we obtain 400.781 feet. The observations are corrected for the elevation of axis of instrument and

Apparent difference in height.........	= 400.781	feet.
Correction for curvature..............	= 1.042	"
Mt. Marcy above Mt. Haystack........	= 401.823	"
Same by mercurial barometer mean of two hundred selected observations.	= 396.570	"
	5.253	"

* The local co-efficient of refraction is yet to be precisely determined. The measurement of Bald Peak and Mount Dix, etc., by spirit level, as a test, is under consideration.
† Only graphically as yet.

Or 5 [redacted] feet apparent difference between the trigonometrical and barometrical results. Without the corrections for curvature and refraction, the results are almost the same (trig. 396·346 feet); and it forms an interesting comparison of the two methods of leveling.

It is apparent, therefore, that Mt. Haystack is somewhat more than 396 feet lower than Mt. Marcy, which, considering the latter mountain 5,402 feet in height, would make Mt. Haystack about 5,006.08 feet above tide level.

Without further example it is sufficient to remark that the trigonometrical leveling — though thorough and exact computation has yet to be made — has indicated, wherever applied as a test, the essential accuracy of the barometrical results, except in cases where the atmospheric conditions were very unfavorable. I shall be satisfied, considering the light character of the necessarily portable instruments, if all the comparisons result nearly as well as the example just given.

Astronomical Work.

The determination of interior points by astronomical observations has been limited, owing to the lack of the necessary standard instruments. Portable astronomical instruments have been concentrated in the hands of the National government at Washington. The State has not even a single large theodolite fit for an accurate primary triangulation, and when a portable transit, alt azimuth instrument or zenith sector is required to correct a survey by astronomical observations, they are not to be had. It would seem proper that every State should be provided with at least one set of standard, portable astronomical instruments to meet the demands of scientific work within its borders. Such astronomical work as I have been able to accomplish, has been necessarily with the portable instruments heretofore described.

Astronomical Azimuths.

Observations for this purpose have been taken at several stations in the interior of the wilderness for the purpose of better adjusting the bearings and triangulation. The great difficulty in such a mountainous and densely wooded country has been to find a sufficient or proper range on which to set an azimuthal station-light or mark for subsequent reference, without changing the astronomical focus of the instrument. The work has, however, been as well executed as weather and the locality permitted, at the following stations, with the instruments named. Other attempts were made at other points, but owing to bad weather, etc., are not considered of value.

Year.	Instrument.	Station.	Star.	Observation.
1872	Troughton & Simms Theod.	Mt. Marcy.	α U. Min.	Upper Transit.
1873	" " "	Long Lake.	"	" "
1873	Wm. Würdeman Transit.	Ampersand Mt.	"	" "
1873	" " "	Bog River Sta.	"	" "

The time of upper transit was selected for these observations for the reason that the approximate latitude of the station could be at the same time taken and with more accuracy than at the time of the elongation of the star, and the consequent necessary reduction of observations to the meridian. Observations, however, were taken at the period of elongation and will be of use.

The determination of magnetic declination ("variation of the compass") was made at the same stations where azimuths and latitude observations were taken and were of course indispensable in the bringing to the true meridian of bearings of points in lakes taken with prismatic compass from boat.

LATITUDES AND LONGITUDES.

At numerous points, also, latitude observations were made with sextant and artificial horizon, of the sun and of stars both on and off of the meridian. A single example of this work by method of British Ephemeris may not be uninteresting.

I select a single observation at the settlement of Long Lake.

APPROXIMATE DETERMINATION OF LATITUDE.

Altitudes of Polaris, out of the meridian.

Barometer standing 28·300; *Attd. Ther.* 45° *Fah.*

OBSERVATIONS.

Double Altitudes of Polaris.	Albany (D. Obsy.) Mean Time.
90°....08′ ...00″	9 h....31 m....00 sec. P. M.

Result of Calculation:

Latitude of Long Lake Station, 43° 57′ 40″·051.

Calculation:

Time of Observation, Albany Civil time (D. Obsy.)	....	9 h. 31 min. 00 sec.
Δ Dud. Observatory from Greenwich long. W. in time	....	4 h. 54 min. 59.52 sec.
Greenwich mean time..........	=	14 h. 25 min. 59.52 sec.
Siderial mean time G. mean noon	=	13 h. 9 min. 41.82 sec.
Time of observation............		9 h. 31 min. 00.00 sec.
Acceleration for 14 h. 25 min. 59.52 sec.	.... h. =	2 min. 17.99 sec.
	.... min. =	4.10 sec.
	.... sec. =	.16 sec.
Siderial time of Observation	=	22 h. 43 min. 4.07 sec.

Then for arc.

$$\text{Observed double altitude Polaris} = \frac{90^\circ\ 08'}{2} = 45^\circ\ 04'$$

Correction for Refraction.

Refraction for	45° of arc	= −	58.″100
" "	0° 04′ "	= −	.136
" "	Bar. 28.300′	= −	3.298
" "	Ther. 45°	= +	.585
Correction for refraction =		−	1′ 00.″949

Corrected altitude of Polaris........	=	45° 04′ 00.″000
For refraction.........	−	1. 00. 949
		45° 2′ 59.″051
Subtract........................		1′ 00.
Reduced Altitude = ...		45° 1′ 59.″051
1st Correction Bro. N. E. = ...	−	1° 5′ 37. 000
		43° 56′ 22.″051
2d " " " " = ...	+	22.000
3d " " " " = ...	+	56.000
Latitude of Long Lake Station		43° 57′ 40.″051

Such approximate determinations of latitude are valuable in locating small interior ponds or other points invisible from our mountain stations; but the *latitudes* and *longitudes* of our survey stations will be all determined by the triangulation, and computed from the astronomical coördinates of the base lines of the U. S. Coast Survey on Lake Champlain, the locations of which are well shown upon the triangulation map at back of this report.

It would, however, be very desirable to determine by astronomical and telegraphic observations the longitudes of several of the westernmost trigonometrical stations, in order to correct and check the triangulation. The ease and absolute accuracy with which time may be sent by telegraph is hardly appreciated by the uninitiated. On one occasion during the past season, it became necessary to procure instantly the exact Dudley Observatory time, when we were one hundred and fifty miles distant from it. Recourse was had to a telegraphic station; despatches were sent and arrangements made, and at the appointed hour of evening, the wires were connected, and the telegraph key in the northern village beat stroke for stroke with the pendulum of the Observatory clock. Each movement of electricity had proceeded to Montreal, Canada; then southward and around Lake Champlain, into the Adirondack region — yet carrying, each second, the regular tick of the clock. Time thus obtained was valuable in insuring synchronous observations in hypsometrical work. It is plain that but little difficulty would be experienced in the application of the telegraphic method to the determination of the longitudes of county corners, etc., as suggested in chapter on Boundaries.

The Adirondack Survey has advanced so far into the interior, and has been so well connected with the base lines upon Lake Champlain, that the latitudes and longitudes of hundreds of points in the interior, including some of the settlements and county seats, may now be determined. The astronomical coördinates of many of the great peaks have already been graphically found by the platting of the triangulation—Mts. Marcy and Mac Intyre with a host of other great landmark peaks being among the number now for the first time located, and during the ensuing season, as but little field work is contemplated, it is hoped that time will be found for the accurate computation of their geodetical positions.

If it is desired that all the angles and sides of triangles should be computed, so as to ascertain the actual distances and bearings of all the different trigonometrical stations or places in the wilderness, some years of work will be required unless suitable assistance be provided. If the platting of the angles determining the positions of points, the complete filling in of topography and hydrography upon the large, final map is deemed sufficient, the map may, if unexpected delay does not occur, be made ready by a year of steady work, showing the results of the survey to the present time.

MOUNTAIN STATIONS.

At the conclusion of work in 1872, I laid before a committee of the legislature, two methods of securing proper triangulation stations, in advancing the triangulation westward into the region of lower mountains, whose summits are covered with forest. The *first* method suggested was to clear the exact apex of the peak, desired as a station, of all its timber, so that the theodolite could be placed upon the exact summit, and measurements be made to lakes below and to other mountains. The *second* method suggested was the erection of log towers upon the peaks of sufficient height to clear the surrounding tree tops; certain of the trees being left to which to attach ropes and tackle blocks for raising the logs. Though the material, ropes, tackle blocks, etc., were prepared, it was found in practice that the cutting of timber for a tower and bringing the logs to the summit, was more than equivalent to clearing the crest for view, and while it was more expensive (the towers requiring usually a height of at least sixty feet to overtop the timber) would be tremulous in a wind that would not interfere with measurements where the instrument was set up on the firm ground or rock. This might have been remedied by an inner tower, to serve as pier for the transit or theodolite; but, in the limited time at our disposal, that was out of the question. The first method was, therefore, adopted, and clearings made in advance of the work, or during its progress, at Blue Mountain, etc., as detailed on pages 36, 45, 46, 48, 49, 50, 51, 56, of this report. The character of the work is explained by the illustrations, plates 8 and 9, which show two of the smaller of the eight choppings — sight-lines and clearings — on Blue Mountain.

This work is both laborious and expensive. The choppers have in each instance, to carry the provisions for their use in packs upon their own backs to the mountain summit, and have then to build a camp. On Blue mountain, where our heaviest chopping was done, water was not to be obtained on or near the summit, and the camp had

to be built some distance down upon the mountain side, at a spot where cold water oozed from the moss and was collected. The assistant in charge, climbing to the top of a central tree, takes bearings of lines which must be cleared, and issues his orders to the choppers below. The water for the use of the men had to be carried up from time to time, from a point half a mile below the crest. The amount of rations estimated being insufficient, one of the guides best acquainted with the country southward, an Indian, was sent hurriedly for more provisions, and was only able to procure them at the second settlement which he visited. Such were the experiences met with in this branch of the work.

If in the future the triangulation be further advanced westward, and a great number of summits cannot be immediately cleared for work — which would require a very large appropriation — it will be impossible to proceed by the present direct and accurate method, and it will be only possible to advance by a system of *trilinear measurements* to the great peaks which have already been well determined. This method is to be avoided in all cases possible, for if extensively used would tend to a constant increase of error.

ANGLES.

To give an idea of the extent of work in the triangulation, I may state that we have now more than forty stations, from which it is estimated that at least fifty lines radiate, having an average length of ten miles each; which would be equivalent to 20,000 miles. If we assume an average length of twelve miles for the side of the various triangles, we would obtain a total distance of 24,000 miles, or the circumference of the earth.

These estimates are rendered more likely by the great lengths of some of the angular lines or sides of triangles; the greatest, so far measured, being from Whiteface to Snowy Mountain, about 51 miles; and that from Mount Marcy to Crain's, or Crane's* Mountain, nearly 40 miles.

From almost all of the eastern Adirondack peaks, also, we have been able to secure angular measurements to Mt. Mansfield, and the Camel's Hump Mt., in Vermont, thus leaping the triangulation across Lake Champlain to the crests of the Green Mountains. It would even be possible to measure the angular distances of peaks in the White Mountains, and thus perhaps make geodetical connection with Mount Washington and the sea coast of Maine and New Hampshire.

Such are the results which these commanding heights enable us to reach; fair examples of the scope and value of modern geographical surveying; through which man reaches by long strides around the earth, and fairly measures and encompasses the globe which he inhabits.

ARC OF THE MERIDIAN.

It has been suggested that the conclusion of the trigonometrical work should be the measurement of an arc of the meridian. The measurements on a reconnaisance have not the precision necessary

* Written both ways.

for such a result, but a computation might, nevertheless, be made, and would — if the termini were established astronomically — be a test of the accuracy of the whole work. The question will be taken up if the data seems sufficient.

STATE SURVEY.

By the errors that have been discovered in the old magnetic surveys — which were necessarily very imperfect — it is evident that a trigonometrical survey of the whole State will be required, before its actual area and the area of the several counties can be determined. Indeed, we may say not only that the State of New York has never been trigonometrically surveyed; but that it has never been surveyed at all; for I was assured by the late State Engineer and Surveyor that he endeavored upon one occasion to make from the county maps of Burr, a large map of the State, and found that the counties which were adjacent to each other would not join as platted; the county maps being merely based on the field notes of the old land surveys.

We are, consequently, entirely behind the rest of the civilized world, having only portions of our coast and of our boundaries determined with accuracy by the United States Coast and the Boundary Surveys. I would urge, therefore, that as soon as may be a trigonometrical and topographical survey of the whole State be made, with the aid of the most improved instruments and methods which modern science has discovered.

The British Ordnance Survey was began about 1745, in the highlands of Scotland, and has since been extended over England, and the whole of the United Kingdom. Under the able management of Gen. Roy, and his successors, the valuable topographical maps were made which, exhibiting every hill or fen, rock or river accurately, enable the assessor to apportion the taxes intelligently, forward public improvements, by showing where labor and capital can be placed to advantage, and even make it possible for the English farmer, at a glance, to determine where he can drain his fields, or where water can be conducted. Their survey has been repeated with greater care and increased accuracy, and numerous maps on different scales have been published; a large and fine one upon a scale of six inches to the mile (in the lowland districts 25 inches to the mile!) on which every house and field, and "almost every tree and bush," with contour lines indicating the differences of elevation are accurately shown. These maps were originally (in Ireland at first) intended to form the basis of fiscal arrangements and internal improvements, and are now acknowledged to be invaluable.

In France, the cadastral survey (Fr. *cadastre*, "a plan from which the area of lands may be computed and its revenue may be valued") has furnished accurate maps of all its provinces; and, indeed, there is hardly at this time a principality in Europe, which has not been trigonometrically surveyed. The triangulation of Prussia, after long and careful work, surveys and re-surveys, has been completed. Austria and Italy, Denmark and Belgium, Switzerland, Sardinia, Tuscany; all Europe has been trigonometrically surveyed and mapped; and while Russia has stretched great columns of triangles over her vast domains, English military enterprise has covered India with a net-

work of angles, connecting the snow peaks of the Himalaya even with Ceylon. In South America, Chili and Peru are also far in advance of us (of New York) and are actively engaged in the trigonometrical survey of the interior of their territories; in Central America, the survey of Costa Rica is equally active. In the United States, the Coast Survey (though its work is limited to the neighborhood of the navigable waters) represents the methods of the surveys of Europe; while United States engineers and the survey of the territories have covered the Rocky Mountains at the heart of the continent, with their angular measurements. But we have examples nearer home. The White Mountains of New Hampshire, the Green Mountains of Vermont, are connected with base lines by triangles; and it is thirty years since the State of Massachusetts completed its astronomical and trigonometrical survey directly at our doors.

Shame at least should move us! The haughty State whose wealth, power and position have gained for it the Imperial title, should know its own area and form, and be no longer forgetful of its proud position and example.

A trigonometrical survey of the State should at once be made; and from the summit of the Adirondacks, the Catskills, Highlands of the Hudson, the Helderberghs, and the mountains in the western portion of the State, counties and towns with all the topography, could be rapidly and accurately mapped, and the long neglected geographical duty of the State to itself and the world be accomplished.

In every department of the State government the result would be felt beneficially. The Comptroller and his deputies would no longer be compelled to rely upon the "Burr's County Maps," on which scarcely a trace of topography appears; assessments could be accurately made and lands described. Beside the Burr's county maps, we have only French's map of the State, made by private surveys, which, while conferring lasting credit upon those who executed it, is nevertheless wrong in places to the extent of miles. Thus the only reliance of the public is seen to be unreliable, and the necessity of a systematic and careful survey becomes more apparent.

That the legislature may understand the origin and methods of the trigonometrical survey of the neighboring State of Massachusetts, I annex an extract from the brief introduction to the "Tables of bearings, distances, latitudes and longitudes," etc., published by the commonwealth.

"The general court of Massachusetts for the years 1829–30 passed resolves (chap. 50) requiring each town in the commonwealth to forward to the secretary's office an accurate map of its territory, from actual surveys on the scale of one hundred rods to an inch. Another resolve of the same year (chap. 58) empowered the governor to appoint a surveyor, with assistants, to make a trigonometrical survey of the commonwealth, accompanied by astronomical observations. A resolve of the next general court (chap. 18) authorized a further measure of a geological survey. Governor Lincoln, whose long administration was

signalized by substantial and permanent monuments, of the most liberal and enlightened policy, and to whose persevering exertions the accomplishment of this, among other objects of high public utility, is materially indebted, took the first steps toward executing the will of the legislature." The chief engineer was Mr. R. T. Paine; his assistant was Mr. J. Stevens, and they were accompanied by Prof. Hitchcock, as geologist; Mr. Borden was employed to construct and repair instruments. "In the spring of 1831, the astronomical and chronometrical observations were commenced by the Chief Engineer, and the surveys and triangulations by the Topographical Surveyor. In 1834 Mr. Stevens resigned the charge of the survey, which, from that time, devolved on Mr. Borden. In 1838 the Chief Engineer also made his final report, and Mr. Borden was intrusted with the completion of the work."

"At this time the field work was supposed to be finished, and a sufficient number of the main triangles had been calculated to cover a section of fifty miles square of the western portion of the State. The town surveys having also been lodged in the secretary's office, Mr. Borden proceeded to the compilation of the map. Here a serious difficulty occurred, which might very naturally have been anticipated. Some of the town surveys made, of course, by practitioners of very different degrees of skill, were found to be extremely inaccurate. The boundaries of the adjacent towns, as delineated by them respectively, did not coincide; the corresponding points of rivers and roads did not meet each other; and Mr. Borden had to go again into the field with four or five assistants, to make corrections. At length, in 1842, the map was projected, ready for the engraver, on a reduced scale of two and a half miles to the inch, or one-eighth part of that of the original plans. Accompanied by a delineation of the Geological Survey, on a reduced scale of one-half of that of the principal map, it was engraved on six plates by Mr. G. G. Smith of Boston, in the best style of that eminent artist, and was printed and published in the autumn of 1844. Its dimensions are seven feet by four feet and a half. It shows the boundaries of towns, the roads, rivers, mountains, the sites of some principal edifices, the topography of the country generally, and the elevations of the principal stations of the triangulation."

"The base line for the triangulation of the commonwealth was measured, 7.3882 miles in length, on the west side of Connecticut river, between points in the town of Hatfield, and on the southern bank of Bloody brook, in Deerfield. The apparatus for the measurement, invented and made by Mr. Borden, proved so perfect that two separate and independent measurements of this long line differed from each other only 0.237 of an inch, a degree of precision which has reasonably excited the admiration of scientific men. A full description of this apparatus, which has since been introduced in the coast survey of the United States, may be found by the professional inquirer in a paper published in the ninth volume of the Transactions of the American Philosophical Society, pp. 33–91. In the operations connected with the triangulation, a twelve-inch repeating theodolite, with a vertical circle attached, made by Mr. Troughton, for Mr. Hassler, of the coast survey, was used to measure the vertical angles, and a telescope, forty-six inches in focal length, mounted by Mr. Borden, to measure the azimuth angles."

"The results of the triangulation were verified by the series of astronomical observations by Mr. Paine, who thus determined the latitudes and longitudes of twenty-seven places in and near Massachusetts. Several of them have also been verified by the United States Coast Survey. The line six or seven miles long between Pocasset Hill, in Tiverton, and Quaker Hill, in Portsmouth, Rhode Island, one of the most distant lines from the measured base, differed but 0.22 of a foot, as determined by the two surveys respectively."

"In digesting the town surveys, in his compilation of the map, so as to reduce the sum of their errors to the lowest point, Mr. Borden availed himself of another important invention first suggested to him by Mr. Alvan Clark, of Cambridge, which has also been introduced into the United States Coast Survey, and into the office of the Topographical Engineers, and by which, it has been said, on good authority, that a sum of not less than five thousand dollars will be annually saved to the country in those offices. It consists in a novel and most ingenious application of the Camera Lucida to the purposes of topographical drawing." * * * *

"The survey of the State of Massachusetts, on which the map lately published is founded, was begun under an act of the legislature, passed in 1831. It was divided into four sections, Geological, Astronomical, Trigonometrical, and Topographical; the last three properly forming parts of one great work, whose ultimate object was to furnish data for a complete and thorough map of the State."

"The tables here given form a part of the data obtained by the Trigonometrical Survey, conducted by Simeon Borden, Esq., combined with the separate astronomical observations made by R. T. Paine, Esq."

"They may be made useful to engineers, surveyors, and others, in all parts of the commonwealth in various ways as follows":

"1. By furnishing accurate data for determining the magnetic variation, and the ratio of its change from year to year, and by affording a test of the existence of local attraction and a measure of its amount."

"2. By enabling railroad surveyors, or others having occasion to measure upon long irregular routes from one town to another, to check their measurements and determine the amount of their error either in length or direction, every time they reach a trigonometrical point."

"3. By affording bases and azimuths for local surveys of towns and of large farms, more accurate than the small instruments in ordinary use are generally able to give."

"4. By making public the exact relative position of some five hundred points, in all parts of the commonwealth, to be used for future reference. These will always afford a basis upon which future topographical surveys in detail may be made, whenever the changes in the surface of the State shall call for a new map, or for corrections in the present one."

"5. By furnishing the absolute geographical position, in latitude and longitude, of about four hundred points, many of them on the coast, where a knowledge of their true position may be useful to the mariner, and all-interesting to the scientific astronomer, or astronomical amateur, who may always refer his observations to some point in his vicinity upon which many thousand observations have been brought to bear, and which cannot, in the nature of things, be greatly in error."

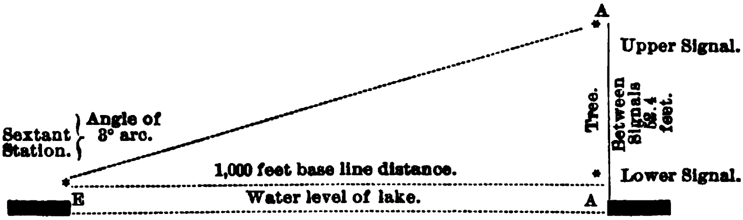
"6. Generally, by awakening in some, and keeping alive in others, a fondness for exactness in their field surveys and calculations, and thus leading to that reform in the present method of land surveying which the rapidly increasing value of real estate in the greater part of the State loudly calls for."

RECONNAISSANCE MAPS.

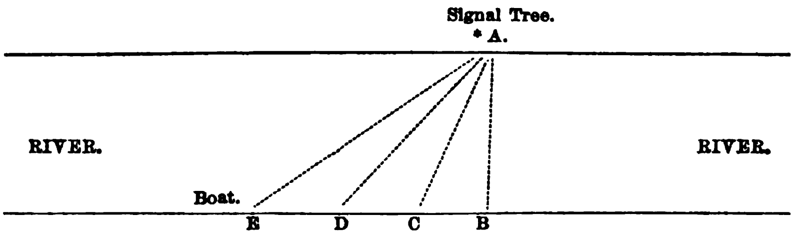
Accompanying the report are three specimens of the reconnaissance maps, (plates 6, 11 and 20,) showing the manner in which the detail of the topographical work is executed. These maps are of various sizes and scales. In explorations of newly-discovered lakes or ponds (the form and meridian of which may have been obtained by azimuth compass, etc.) without as yet a connection with the triangulation, the map sketch is founded upon a distance between prominent points in the lake, lettered A and B in the reconnaissance sketches. This distance, called a *lake base*, is assumed as the unit of measurement, the length of which is to be afterward determined.

It is designed in future work of this character, to obtain this base line distance either with telescopic micrometer, or by a new method which I have discovered and tested. By this method, base lines of 500, 1,000 or 1,500 feet, etc., may be obtained accurately in a few minutes, for the triangulation of a lake. The only instrument required is the sextant, and no assistant surveyor is necessary. Immediately upon launching canoe or boat, a rapid exploration of the lake, the form of which is desired, should be made, and a deep, semi-circular bay selected for the commencement of the work. Landing at one side of the head of the bay, and selecting a point at the water's edge where happen to be tall trees growing, a signal is set up at the foot of some tree on the shore, and a man climbing the tree with a line, suspends from a branch another signal, seldom more than fifty feet above the first, by careful measurement. This line of fifty feet distance, is to form the perpendicular of a right angled triangle, the base or horizontal of which is supposed to extend across the water to the opposite shore of the bay. I will suppose that a base line of 1,000 feet across the water is desired. By tables which I have computed, and have carried with me, I find that a perpendicular of a little more than 52·4 feet, at a distance of 1,000 feet subtends an angle of 3°. (three degrees of arc.) The perpendicular is made of that length. Re-entering the boat, the limb of the sextant is adjusted by the vernier to read to three degrees of arc, and the boatman is directed to row to the opposite shore of the bay. Then, keeping the same distance above the water as the lower signal, an observation is taken, and if the upper edge of the upper signal — as reflected — coincide with the lower edge of the lower signal, the distance is 1,000 feet. If they do not coincide, the boatman is to be directed to row either nearer or further off along the oblique

shore, as the case may require, until they are coincident. Then, landing on the shore, a more careful observation is taken, a little further off or a little nearer, and here a signal flag is erected representing the other extremity of the thousand feet as found. From these points the triangulation of the lake can proceed. So many of the lakes are inclosed by steep banks, along which it is almost impossible to measure a base, yet have everywhere upon their shores, trees which are available for the application of this method, that it is extremely useful in lacustrine reconnaissance; for this lake base-line can be subsequently tested and corrected by triangulation. The annexed profile will, perhaps, render the method more intelligible:



The need of the perpendicular or vertical signal staff (tree) which is the stadium of the work, will be better understood after an examination of the following horizontal plan, representing a broad river:



In this it will be supposed that E to A has been found to be a distance of 1,000 feet. The distance A to B is found to be too short; A to C is tried with the same result; likewise A to D; and, finally at E the sextant indicates the desired distance. It will be at once seen that it is only the perpendicular placing of the stadium (signal tree) that admits of obtaining the oblique base-line E A by the measurement of a single angle with sextant, at E; for if the signals were placed fifty-two feet apart, horizontally, on the river bank, the distance A B, only, would be obtainable as side of a right angle, and a computation would be necessary, after which one would only obtain an irregular fractional distance, difficult to plat with accuracy on the reconnaissance map. The same fractional result would be obtained if a short base were measured horizontally, and a theodolite employed, as in ordinary triangular measurements; and while this would require the setting up, centering and leveling of the instrument at each point — which is often impossible on account of the steepness of the shores — by my sextant method, a few strokes of the oars carry the surveyor to the further extremity of a long base line, whose index is unity, and which can therefore be platted upon any scale with accuracy and rapidity.

In practice it has often been found more convenient to use a shorter perpendicular; ($17\frac{45}{100}$ feet of my tables;) but, in accordance with the laws of trigonometry, the more acute the angle at E, the greater the liability to error. Nevertheless, a perpendicular of 50 or 60 feet is only obtained with labor hardly commensurate in reconnaissance to the slight increase of accuracy. Refraction and curvature, also, influence the result, but so slightly that they may be disregarded; the combined effects at 1,000 feet, resulting in a depression of the distant lower signal of less than a quarter of an inch. It is desirable, however, that the lower signal of the stadium, and the station of the sextant should be at least six or eight feet above the water in order to avoid the variable refraction near its surface.

The reconnaissance maps are of different classes. Of the first, or

PRELIMINARY RECONNAISSANCE MAP,

plate 11, is an example. In the preliminary work, the great point is to place upon paper all the main facts in regard to the section covered by the map sheet. The new lakes, ponds or water-courses discovered by exploration are rapidly noted upon it; the direction in which the streams flow, and to what main branch or river they belong; the location of impassable swamps, etc.; are all carefully recorded. The mountain ranges, with their prominent peaks, the cliffs which form impediments, and the summits which will aid in the coming surveying operations, are noted thereon, with the mountain passes or notches; and, a lake which cannot be located by a measurement, is nevertheless jotted down, so as not to be forgotten in future operations. In short, every thing which is discovered by the exploration is placed in its approximate position on this preliminary sheet. In all cases the mountains are sketched in the field in red lines, the lakes and streams are drawn with blue color. This prevents any possibility of mistake of a mountain line, for a stream, and *vice versa.* This feature is well shown on the reconnaissance map specimens attached. A case of liquid colors, with pens and brushes, forms a necessary part of the topographer's outfit; and the great contrast of the colors prevents the occurrence of any doubts in the subsequent copying and drafting. The red line of a ridge can by no possibility be mistaken for a stream, which would be blue. The preliminary sketch affords the basis for the

SECONDARY RECONNAISSANCE MAP.

This is founded upon the triangulation; the mountain peaks and principal stations having been platted from the trigonometrical measurements — the minor portions of topography filled in around them from the preliminary maps — and, if possible, corrected in the field as far as may be with the time at command. In the secondary map, also, the mountains are drawn in red, and now altogether in *red contour lines;* obtained at times with hand level, used from mountain side. In this work the pocket aneroid is sometimes of assistance, but has not been relied upon. When the contour lines are completed, I usually fill in the space between with black, vertical hatchings, which render the shape more intelligible to those unaccustomed to contour lines, and with an occasional touch of the brush these vertical hatchings give a remarkable aspect of relief to the mountain peaks and

ridges, making them stand out sharply from valleys deep with gloom. It is not usual to place even approximate latitudes and longitudes upon the reconnaissance maps, that being left for subsequent determination; the magnetic meridian is, however, noted, and the declination, whenever determined. In the specimen of secondary map (plate 6) the magnetic variation shown, is suspected to have been subject to a local disturbance, at the time of observation, which is peculiar to such peaks.

In preparing the final map, all the preliminary maps have to be reduced to the secondary form, at least, filling in the areas around trigonometrical points. In each section designed to be transferred and corrected, the angles are first platted, and then all the data from the field books and preliminary maps carefully scrutinized, and piece by piece transferred to the secondary map, which though on a smaller scale than the field maps, is sufficiently large to afford the draftsman freedom in the execution of the detail. After the whole area under survey has been thus transferred, a re-examination of every sheet is to be made, and the data for every point tested again, and compared with the plat, which, if found correct, is ready for reduction to the scale on which the final map is designed to be published. This final map is to be carefully executed, as it forms the copy for the engraver. It is advisable that in this portion great care be taken to insure the transfer, by the engraver to stone, with the map-paper DRY, and constantly at the same temperature; otherwise the different sheets in which it is necessary to print a large map will not join; roads will not meet roads, nor streams join streams; a defect which is frequently to be seen on large wall maps. So much of the value of a topographical map depends upon the accurate copying of the original, that I would advise that the map of this survey be engraved after the method of the U. S. Coast Survey. They are prepared on copper at the office in Washington, by their own engravers, who are possessed of great skill in the art. The value of the map is thus increased; for the copper permits the most delicate portions of the work to be finely and accurately shown.

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* The secondary map may be followed by tertiary, etc., reconnaissance until the requisite degree of fullness of detail is obtained.

GEOLOGY, ETC.

In complete topographical surveys it is not infrequent to include a geological and mineralogical reconnaissance. It is indeed a favorable opportunity for work of this character, the co-operation and mutual assistance of the parties facilitating the work of each; the geologist obtaining the lengths, distances and elevations of rock formations, or of synclinal and anticlinal axes, by simply directing the attention of the surveyor to the points advisable to determine, and the surveyor reaping equal advantages, from the explorations of the geologist, of important topographical features of the country.

During all my earlier explorations of the Adirondack wilderness, I had given special attention to its geology and mineralogy, and kindred subjects; securing specimens from all portions of the region, and much valuable general information. Since the State became interested in the survey, however, there has been little time for geological study, other than the recording of the most important facts observed *en route*. The work to be executed was chiefly the triangulation of the great mountain peaks, and afterward such topographical mapping as was most important and possible. Imagining, however, that some remarks in regard to a few of the most important observations may not be improper, I will mention them briefly, without technicality.

In geology and mineralogy, the extent of the *hypersthene* or *labradorite* rock (*Norian* of Hunt?) has been studied, and has been found to extend over a far greater area than heretofore suspected; the mountains which are composed of it have been noted, and its out-crop upon lake shores, etc. Prof. Emmons, then State geologist of the second district, in the report on the survey of this portion of the State, affirmed that this rock was peculiar to Essex county. In this he erred, for I have since traced it into another county, and suspect its further extension. In some localities it contains *magnetic iron* disseminated in small grains. These crystals often affect the compass needle, or the dipping needle, and lead to the suspicion of ore, when only these particles really exist, few and far between. The extent of the brown and gray gneissoid rocks of the so-called Lower Laurentian formation, has also been studied, and suggests important inquiries in geological theory. The *crystaline limestone* has been found in many localities before unknown, and is accompanied by the usual minerals. It is frequently penetrated with dark masses of granular *schorl*. In

the adjacent gneiss, gigantic crystals of black *tourmaline* are met with, and where magnesia enters into the chemical composition of the rock, *serpentine* is generally found, in nodules of very beautiful character, though it is generally poor and worthless.* *Amianthus* of very short fiber sometimes makes its appearance associated with the serpentine, but genuine asbestos is very rare. *Rutile* or titanic acid, however, is unfortunately well disseminated, and enters into combination with some of the iron ores found in the central portions of the region. Its combination with magnetite, claimed, may be assumed to be $\ddot{\mathrm{F}}\mathrm{e}$ 68·54, $\dot{\mathrm{F}}\mathrm{e}$ 30·18, $\dot{\mathrm{T}}\mathrm{i}$ 2·03; but judging from foreign analysis (octahedrons from the Vogelsbergh affording Knop $\ddot{\mathrm{F}}\mathrm{e}$ 21·75, $\dot{\mathrm{F}}\mathrm{e}$ 51·29, $\dot{\mathrm{T}}\mathrm{i}$ 24·95, $\dot{\mathrm{M}}\mathrm{n}$ 1·75), the titanic acid may, in some specimens, amount to nearly 25 per cent of the ore. An ore resembling *menaccanite* has been met with, and may have the composition of the variety found by Hunt in similar Canadian rock, which afforded on analysis $\ddot{\mathrm{T}}\mathrm{i}$ 48·60, $\ddot{\mathrm{F}}\mathrm{e}$ 10·42, $\dot{\mathrm{F}}\mathrm{e}$ 37·06, $\dot{\mathrm{M}}\mathrm{g}$ 3·60 (99·68). In the central and southern portions of this region, the rocks are almost barren, and the only trace of iron found is generally in the form of bisulphuret, in small veins through felspathic rock. The bog iron ore occasionally found, is contaminated with both phosphorus and sulphur. Much of the so-called "iron ore," to which my attention has been called, was merely the black-jack of our iron miners; here, a black, massive hornblende. *Schorl* is also mistaken for coal by country people on the borders of the wilderness, who are not aware that the geological formation here contains no coal. Other ores, and numerous minerals have been met with, but nowhere in quantity, and there is not space for reference. The chief mineral of the region is magnetic iron, which exists in wonderful masses, and of apparently excellent quality, though the mean chemical composition of the beds of the interior has not, as yet, been sufficiently investigated.

The iron ore of many of the unworked beds, such as that in the vicinity of Lake Sandford, and elsewhere, have the reputation — whether justly is yet undetermined,— of containing a large percentage of titanium, and are, consequently, by some considered valueless.†

I suspect that the "natural steel," which has been alluded to by some in glowing terms as a product of certain of the Adirondack iron ores, may obtain its character from titanium.‡ As a *metal,* it seems to have been unknown to our mineralogists and geologists, for in the New York State Mineralogy, page 55, the cyano-nitride of titanium, which occurs in copper-colored cubic crystals ($\mathrm{Ti\,Cy_2}$, $\mathrm{3\,Ti_3\,N_2}$), has, I find, been described as the true metal, whereas titanium is a gray, amorphous powder. The views of Dr. Wollaston were here evidently accepted by Dr. Beck, and this is but one of a myriad of examples which might be given showing the need of a re-survey of the mineralogy of our metamorphic rocks, in order to bring the records up to the standard of modern discovery. At the time of the first survey, the Adirondack wilderness extended to the very borders of Lake Champlain on the east, to the St. Lawrence on the north, and even over portions of Jefferson county (toward Lake Ontario) at the west. Since

* I do not refer to the beautiful beds of serpentine on the borders of the wilderness in Warren Co., or to the quarry of this stone recently opened near Port Henry, Essex Co., which is of superior quality. These beds are not within the wilderness.

† This popular opinion is discredited by excellent authorities who claim that titanium iron will afford good steel if properly treated See Appendix E.

‡ *I have also found rutile (oxide of titanium) in crystals and threads in the lime rock used as a flux at the old Adirondack furnaces.*

then large areas of the lowlands have been cleared and settled, and the rocks laid open to view. At the same time, the science of mineralogy itself, through the efforts of Dana and others, has been so changed and improved with the aid of chemistry, that all its past seems to have been but a stepping-stone to its present. Mining and practical metalurgy, also, have been studied scientifically with grand results, by some of the finest intellects of the age; chemistry has become indispensable to mineralogist or metalurgist; the causes which have stopped the working of many a mine or furnace have been investigated and obviated, and in other states of the Union, and even in the territories, the development of the mineral wealth of the country has been extraordinary. The times seem to demand at least a re-survey of northern New York, by practical miners or mining engineers, in order that our natural resources may have the same advantages from modern science that neighboring states possess; that ores hitherto thought worthless may be made available, and new ores discovered, tried and analyzed.

A volume might be written upon the subject of the ores, which are principally found on the margins of this wilderness, but I will not venture to give more than these suggestions here.

As a matter of zoölogical and general interest, I may mention that in a few of the most remote portions of the wilderness we have met with indications of the Moose, which, to some of the guides, seemed unmistakable. This gigantic deer is, however, almost extinct in the Adirondacks, and I would suggest that it be made, in future, unlawful to kill or destroy the animal at any season. Beaver, also, are still to be found in one or two localities, and should be similarly protected by law. The bear, panther and wolf, etc., are still sufficiently abundant, and afford support to some trappers, who make them almost their sole object and means of livelihood. The common deer are extremely plentiful in some sections, and almost wanting in others — their absence in localities being attributable to the practice of constant driving or hounding, which soon sends those (which are not driven to water and killed) to less disturbed feeding grounds. While in the eastern portion of the forest, we were compelled to pack in, by back-loads, the pork and meat required for the command — at considerable expense, both in its purchase and transportation — in the latter portion of the season, in the interior of the wilderness, the guides kept us constantly supplied with fresh venison. This was a saving in many ways. The venison ran upon the hoof till wanted, and was therefore so much load off the shoulders of the guides. Without it several journeys back to the settlements for provisions would have been necessary, greatly hindering our explorations, and probably causing so much delay that the ice would have cut us off from some of the most important discoveries of the season. On fair ground, it was generally only necessary to order a guide to kill a deer, in order to secure it. It is, therefore, very advisable that a professional hunter be attached to all surveying parties working in the remote portions of this region, to provide them with meat.

Almost all of the new lakes mapped, abound in immense speckled or brook trout — some of them of wonderful size and weight, reaching three and four pounds — true *salmo fontanalis*. As a matter of special

interest, I may mention our discovery of huge trout in one of the brook inlets of Lake Colden, near Mt. Marcy, and in the lake itself. This is probably the highest point at which trout are found within the State, Lake Colden being over 2,700 feet above the sea. For two years I had suspected — against the incredulity of guides and hunters, that there were trout, and large ones in the lake, having seen them leaping from the water at evening. The proof of their presence was obtained in a singular manner. The assistant near the inlet at the lake level, taking synchronous observations for the measurement of Mt. MacIntyre, saw what he supposed was a muskrat swimming up the inlet, and called a guide's attention to it. It proved to be a brook trout of over six inches depth of body, half out of water, trying to ascend the stream! Two of these monstrous fish, of between three and four pounds weight, formed a sufficiency for the whole survey party that evening at supper.

The minute lamellibranchiate shell, which seems to be undescribed, discovered in Moss lake or spring, near Mt. Skylight, at an elevation of 4,300 feet above the level of the sea, may be interesting to conchologists. It is a beautiful little bivalve, having a pale, brownish epidermis, the dead specimens being quite white, and would seem to be a *cyclas*, resembling the *c. partumeia* of Say and De Kay, but smaller. Of the largest of the many specimens collected, the transverse diameter is 0.25″, and the vertical diameter 0.20″; the shell is a thin, rounded oval, with a glossy surface, with fine concentric lines, but no radiating lines visible even under the glass. It is smaller than the species found in the swamps throughout the State, and is interesting from its elevated habitation — the most elevated of any of our fresh-water molusca.

In regard to the flora of the region, my observations have been confined to some notes upon the valuable varieties of timber, and the measurement of the altitudes at which certain varieties cease to grow upon the mountain sides. The remarkable and wide-spread mortality among the majestic spruce trees (*abies nigra*), has been frequently observed, and I have remarked that only the larger and maturer trees seem to be attacked by it. This disease of the spruce trees is receiving the close attention of the State botanist, who has accompanied me in many expeditions into the wilderness, and during the past season has prosecuted with his usual energy and enthusiasm the search for new and rare plants for description and preservation in the State herbarium. He has given particular attention to fungi of the wilderness, and has discovered hundreds of species new to the State, and many which are new to science. His conclusions in regard to the disease now affecting the spruces cannot fail to be valuable.

ADIRONDACK PARK.

The explanations and descriptions throughout the report are sufficient to give a general idea of the wilderness and its capabilities.

In regard specifically to the proposed park or state forest reserve and the area or portion advisable to be taken for that purpose, a brief statement will be sufficient.

I would recommend that at present only the high mountain region — the *heart of the Adirondack* — be taken. This section includes Mt. Marcy and all the great peaks of 4,000 and 5,000 feet altitude, and is indisputably valueless for agriculture.

The climatic observations of the survey, as detailed in the chapter on Hypsometry, indicate that an elevation of 2,000 feet above the sea in this region is equivalent to four degrees of north latitude, and, therefore, even the lakes and valleys of the Mt. Marcy region should have a winter climate as severe as that of the barren region north of the head-waters of the Saguenay river in Canada, while, in summer, also liable to the sudden cold and frosts peculiar to a northern mountain region.

It would, therefore, seem advisable to test the practicability and value of the proposed park first in this broken and wild mountain portion, where massive rock forms the whole substance of the mountains, and the narrow valleys — unless in swamps — show only rocky detritus and sand, or the wooden soil derived from the decay of moss and tree. The timber — trees clinging to the rocks with rope-like roots — and the iron of this section are its only commercial advantages. In the interest of navigation, for the sheltering of snow and the modification of evaporation the forest is more valuable as growing, than as fuel in iron manufacture; for, while charcoal iron is superior in quality, the cheapness of coal made iron renders the former unprofitable. For lumber most of this upland timber is too poor and small, and almost all of that upon the mountain sides at present practically inaccessible. If this section should be taken by eminent domain, it might be well to except all mines of iron which have been opened or operated, and to encourage their operation, and the carrying of the ore out to the cities where furnaces and coal await it, and where its manufacture would afford employment to thousands of the poor.

The region which I thus suggest as the nucleus of the park is bounded on the east by the Schroon Valley and Pass, from Root's to Elizabethtown; on the north by the settlements of Keene or the Keene and North Elba Road; on the north-west by the Saranac Lakes; on the west by the Raquette River and Long Lake; and on the south by what is known as the Carthage Road, extending from Long Lake to

Root's. The area thus separated would afford the State the control of the Catlin Chain and outlet of Long Lake — the key to the western waters which I have so often recommended for feeders of the Champlain Canal.

The area of the section thus recommended is not far from 600 square miles or 384,000 acres, and with but trifling exceptions consists of abandoned lands, unremunerative and almost valueless — the only lumbering or timber cutting being along a few of the low-land or lake valleys.

It forms but a small portion of this northern forest region; is acknowledged to be cold, sterile and useless for farming; it embraces the sources of the Hudson River and lakes already used as reservoirs by lumbermen; and besides contains the highest mountains of New York — a region of wonderful beauty and picturesqueness which, under control as a park, and preserved from ruthless desolation by fire, can be made as profitable to this State by travel and traffic as Mt. Washington and the White Mountains are to New Hampshire.

DISTRIBUTION OF REPORTS.

To the Smithsonian Institution, through Prof. Joseph Henry, I am indebted for the distribution to scientific societies, both American and foreign, of some hundreds of bound volumes of the report of the Adirondack survey for 1872. They were also distributed directly from this office to government and state libraries of the several states; to general libraries; the libraries of Christian associations, and to all scientific organizations, when desired. Acknowledgments have been already received, some from China, some from Russia, all showing an appreciation of this survey.

CONCLUSION.

The Adirondack wilderness may be considered the wonder and the glory of New York. It is a vast *natural* park, one immense and silent forest, curiously and beautifully broken by the gleaming waters of a myriad of lakes, between which rugged mountain ranges rise as a sea of granite billows. At the north-east the mountains culminate within an area of some hundreds of square miles; and here savage treeless peaks, towering above the timber line, crowd one another, and, standing gloomily shoulder to shoulder rear their rocky crests amid the frosty clouds. The wild beasts may look forth from the ledges on the mountain sides over unbroken woodlands stretching beyond the reach of sight — beyond the blue hazy ridges at the horizon. The voyager by canoe, beholds lakes in which these mountains and wild forests are reflected like inverted reality; now wondrous in their dark grandeur and solemnity; now glorious in resplendent autumn color of pearly beauty. Here — thrilling sound to huntsman — echoes the wild melody of the hound, awakening the solitude with deep-mouthed bay, as he pursues the swift career of deer; the quavering note of the loon on the lake; the mournful hoot of the owl at night; with rarer forest voices have also to the lover of nature their peculiar charm, and form the wild language of this forest.

It is this region of lakes and mountains — whose mountain core is well shown by the illustration "the heart of the Adirondacks" — that our citizens desire to reserve forever as a public forest park, not only as a resort of rest for themselves and for posterity, but for weighty reasons of political economy. For reservoirs of water for the canals and rivers; for the amelioration of spring floods, by the preservation of the forests sheltering the deep winter snows; for the salvation of the timber — our only cheap source of lumber supply should the Canadian and western markets be ruined by fires, or otherwise lost to us — its preservation as a state forest is urgently demanded.

In pursuing this exploration and reconnaissance of the region, I have used every means at my disposal to secure the most results during the

time at command. It was this desire for progress and full success which led to those extraordinary night marches through the forest wilderness — merely hinted at in the narrative — which were probably as unparalleled as they were dangerous. Each portion of the work had its allotted time; and when, at last, after a period of gloomy storm a clear and brilliant day was vouchsafed us upon a mountain peak, every minute was given to the angular measurements; and only when the settling gloom of night made the vernier unreadable, was the order given for the descent from the chilly peak. It has required the greatest activity to keep the whole work in systematic motion, for at times the waiting for clear weather threw us days behind the allotted time; yet during the latter portion of the season, seven different survey and signal parties working in different portions of the wilderness by orders issued weeks or a month before, (the parties separated by distances of twenty, thirty and fifty miles without means of communication,) nevertheless executed their work successfully. Sometimes the failure of provisions led to forced midnight marches through portions of the wilderness which hunters and trappers had often deemed sufficiently wild to be traversed with care by day; and sometimes by night through portions, which in all probability had never been trodden before by man. Thus I have to record the descent of almost all the great peaks of the Adirondack at night; a memory of thrilling work, perhaps only justified by success.*

The severe weather and hardships of autumn and early winter in the wilderness, were endured for the sake of the peculiar facilities which that season of the year gives for exploration for unmapped lakes. At this season all the deciduous trees have lost their foliage — beech, maple, birch and ash — and leafless, make the hills appear gray and grisly; a sea of naked and bristling branches. The covering of the forest is removed, the bare poles alone remain, and now from the hill tops the view out into the wild forest valleys is often almost unobstructed. Now we can discern the glimmer of lakes; and the late changing or ripening of foliage of one variety of tree, often reveals the most valuable topographical secrets — a peculiar, long, yellow streak indicating tamarack timber — the *hackmatack* which fairly feeds on

* The most noteworthy night descents were Wallface mountain, Mt. Colden, Mt. Dix, Mt. Marcy, Mt. MacIntyre, Blue mountain, Graves mountain, etc., etc., etc., besides night marches in the Keene, Mt. Seward, North Elba, Oswegatchie regions, etc.

water. It then requires only to be determined whether there is any wide opening in the forest there, and then a quick march to it discovers whether it is a wide peat moss or lake. Generally the yellow tamarack in the remote sections points to a *new lake!*

These are sufficiently potent reasons for autumnal explorations; our winter work was designed to be the measurement of base lines on the ice, only prevented by the snow, which came down soft and deep, hindering the ice from freezing sufficiently strong. It was this snow, unusual and unexpected, which rendered the lakes neither navigable nor traversable on foot, and which occasioned the loss to us of our boats, and the weeks of painful journeying and labor that might have been made a matter of days in summer.

Of the more important discoveries of lakes and of mountains mention has already been made; the list of ponds gives some idea of the former while the table of altitudes afford the principal measurements which we have so far computed.

In the verification of my previous discovery of the loftiest pond source of the Hudson, we obtain the definite and permanent settlement of an interesting question, and hand over to Geography the course of the mighty river from the lone lakelet spring, downward by steps of foam, to its broad, haughty and historic tide. From the loftiest lakelet of New York the water descends, gathering volume at every brook, till in full breadth it swells before the wharves and piers of the metropolis, floating the richly burdened ships of all the nations.

To the number of those chilly peaks amid which our principal rivers take their rise, I have added by measurement a dozen or more over four thousand feet in height, which were before either nameless or only vaguely known by the names given them by hunters and trappers. The names and measurements will be found in the table of altitudes. It is well to note that the final hypsometrical computations fully affirm my discovery that in Mount Haystack we have another mountain of 5,000 feet altitude. It may not be uninteresting, also, to remark that the difference between the altitudes of Mt. Marcy, and Mt. Washington, of the White mountains of New Hampshire, is found to be quite 800 feet. Mount Marcy, Mount Mac Intyre and Mt. Haystack, are to be remembered as the three royal summits of the

force is difficult to determine, but by that means the men who become acquainted with the methods of work and needs of the survey would be retained and delays owing to new, untaught men would be avoided, while better work would be obtained The excellent character of the Adirondack guides would render this hardly necessary; but at times, after a month of marching through the forest, even the guides will long for home and rest.

As during previous seasons, the use of alcoholic or fermented liquor of any kind was prohibited to any one connected with the survey, and neither while engaged in the laborious climbing of the mountains nor while encountering bitterest storms or the severity of winter's snows, was any stimulant used or carried. The result has been steady and persistent work, and men who have believed stimulants absolutely necessary have expressed a change of opinion. But for the stern and strict enforcement of this rule, fatal accidents might have occurred in the mountain climbing.

To the volunteer assistants I desire to tender my thanks for their attention to duty and their general interest in the survey.

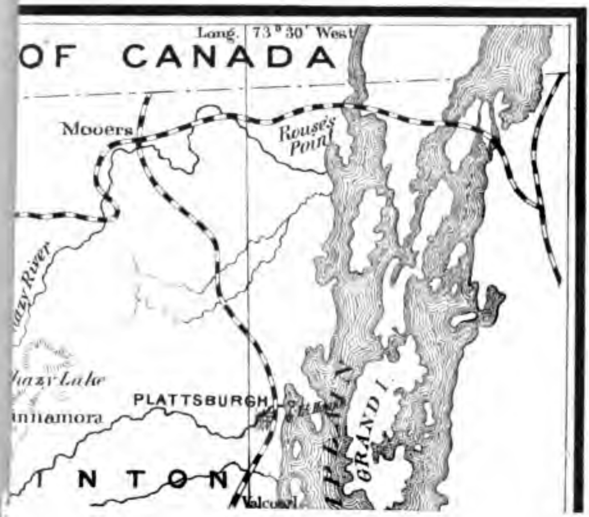
In conclusion I have the gratification of knowing that this triangulation is the first general scientific measurement of the angles formed by the different peaks. We cannot but be impressed by the lasting and permanent character of such work, when we contemplate the fact that during countless ages to come; though governments may change, states cease to exist and the sweeping flames of war and revolution destroy even our civilization; yet these great monarch mountain peaks will remain as measured, immovable and unchangeable, save by the hand that created them.

The required outline of the survey and of the results — constituting this report — is now before the Legislature. It has been my endeavor to simplify and make it suitable for general distribution. Technicality has, therefore, been avoided, and illustrations and specimens of work have been given.

All of which is respectfully submitted.

VERPLANCK COLVIN.

ALBANY, *April* 20, 1874.



Long. 73° 30' West
OF CANADA
Mooers
Rouse's Point
PLATTSBURGH
GRAND I.
INTON

APPENDIX A.

Description of the Illustration and Maps.

List of Plates

Plate 1. Station at Crown Point light-house for connection with the U. S. Coast Survey triangulation. This is a type of the light-houses on Lake Champlain, which, from their well determined geographical position, I have selected and used as the datum of measurement for the Adirondack survey. This light-house is situated at the narrowest portion of the main body of Lake Champlain. The view is from a station to the east of the famous — now dismantled — fortress of Crown Point, and shows a portion of the narrows — the lake greatly contracted. The residence of the keeper is at the foot of the tower which is accessible from his house by a hall-way. The tower itself is well built of blocks of blue lime stone, and is octagonal in form. A spiral stone staircase within, leads to the turret which contains the lantern, and the superb — imported — Fresnel lens. The form of this light-house did not admit of our measurements being made from its centre. The theodolite was, therefore, placed upon the balcony, and the proper distance and angular measurements taken for reduction to centre. From this light-house Mts. Mansfield and Camels Hump in the Green Mountains, and Bald Peak, Mt. Dix, the Giant, the Cone, Green and Macombs' mountains of the Adirondacks are visible; besides the coast survey stations. Nine of the Lake Champlain light-houses were made use of for the Adirondack survey.

Plate 2. Automatic signal for great distances. This is a representation of a *stan-helio* signal of the first order. The original form of this signal was that of a dome, but, as under the influence of heavy winds, the sheets persisted in collapsing, the form shown in the illustrations was finally adopted. The heaviest bright new tin was selected, and the proper holes having been punched at the edges, the sheets were put up in packages of twelve each, with a sufficient coil of wire to connect them, and suspend the signal from a standard at its centre. The signals of this size make a compact package and weigh each eleven pounds and ten ounces. It does not take many of them to make a back load for a guide. They have been set up at many different stations throughout the wilderness, and without them I should have been unable to have accomplished our work during the past season. The form is peculiar, and there are so many different angles of reflection, that so long as the sun shines, this signal throws forth in every direction, streams of light which make it appear like a fiery star even

at a distance of twenty or thirty miles—showing exactly in what portions of the region our previous stations had been. The timber for mounting it is cut in the forest. The standard or upright is first prepared and notched at the top for the reception of the wire collar, from which four wires extend to the upper corners of the signal and alone suspend it, so that it sways in the mountain wind, and at every motion multiplies the number of angles of incidence and of reflection. The standard is cut sufficiently long to prevent the signal—when swept by a violent gale—from being blown over it, and in practice it has been found to readjust itself on the subsidence of the storm. though they cannot be expected to remain in tact through winter. The foot of the standard is secured so as to maintain it in a vertical position with logs, etc., upon which great rocks are piled until the structure is firm.

Additional particulars in relation to this signal and of its discovery, are given on pages 10, 11, and 12. Its peculiar form, its light swaying motion, (limited by wires from below) the positions, relative to the horizon, of the different sheets, which to obtain the best results are kept perfect planes, being the proper angles to reflect the sun in the same directions at different hours of the day, and the great distances at which, by these means, the signal is made visible, constitute its difference from the small stationary scrap tin or truncated cone signals which are only visible at short distances.

Plate 3. Bald Peak primary triangle. The upper portion of this plate is a horizontal plan showing the condition of this important triangle, and the means by which its actual form, and the exact position of our station of Bald Peak have been determined. The Bald Peak is the most elevated mountain midway upon the shores of Lake Champlain, forming indeed a sort of disconnected culmination of those lake shore mountains, which, along the New York side of the lake are, like an irregular wall, interposed between the lake and the interior mountains; cutting off the view of Adirondack peaks from almost all of the light-house or other stations geographically well determined. The effect of this coast range of granite ridges, is well shown in the perspective and sectional plan, where the dark section of Bald Peak will render easily apparent the substantial character of this wall, hiding the interior region from the lake Champlain stations. Yet while thus interposing, to prevent a rapid advance into the interior, this range has only rendered one additional set of triangles necessary; and the Bald Peak has proved a commanding and advantageous station, from which lines of angular distances have been radiated to a great number of the prominent peaks of the interior. In the illustration (horizontal plan) A, C, B, is the form of the triangle as we originally attempted to measure it. Deceived by existing maps, I had supposed that the lake from Crown Point light-house to Barber's Point light-house was unobstructed. On reconnaissance, as described in the report, it was found that the Vermont shore, forest covered, intervened, and the coast survey office having furnished us only with the locations of the two light-houses, we were at fault for lack of datum. I have heretofore described our labors upon this triangle; suffice it to state that the work was commenced here in August, 1872. (See report for that year.) After meeting with the difficulties described, a new plan was adopted. Starting with an undetermined point, *a* of illustration, which was visible from the Barbor Point light-house, we measured the triangle a,

c, b, and subsequently measured accurately the base line (a to a) with iron wire previously carefully straightened, and brought to the proper tension, somewhat described in the U. S. coast survey directions for such operations. From each end of this base line, the angular distance between the line and Crown Point light-house was measured, and the distance of the light-house from station a (known to us as Crown Point sub-station) was taken and subsequently computed, affording with the other data, the means for reduction to centre, or more simply, ascertaining the true angular form of the triangle A, C, B.

I should have much preferred a direct measurement of the triangle, but our second reconnaissance (of the forest on Vermont shore July 29) proved that the expense and time required for cutting a sight-line through the timber intervening would be too great. By the next ascent of Bald Peak, on July 30, I was enabled to measure to and determine the small angle A, C, A, but it was at length found necessary to leave this work temporarily. The last measurements at this station were made December 3, at the conclusion of the work on the third division. With the aid of the U. S. coast survey base line, and their station north of Port Henry, additional measurements were made. The position of Crown Point sub-station *a* was determined from f, and sufficient data obtained for the accurate platting of the triangle. The map work would, however, be much simplified, and the chances of error in platting decreased, if the horizontal angles A and B could be directly measured, the timber interfering being cut away.

In the illustration, the radiating lines at the left from Bald Peak, represent a few of the angular lines to distant Adirondack Peaks.

Plate 4. Mount Hurricane primary triangle. The arrangement of the triangle was like that of Bald Peak, adopted for the purpose of connecting the Adirondack survey triangulation with the United States coast survey work, in order to secure an accurate base line for our work without the great labor of its measurement, having termini well established, astronomically and geodetically, and of sufficient size for accurate platting on a small scale. The disheartening search for a mountain station suitable for the vertex of the great triangle (which had been part of my plan for the triangulation) is given in the narrative. When all the mountains which had been supposed to be available, had been fruitlessly climbed, I at length found in Mt. Hurricane, a peak of the interior ranges, far in the rear of the lake shore mountains, the desired station, reaching at once by one long unhoped for leap, to the very margin of the wilderness. At the same time the great length of line adopted as a base, gave the angle a better conditioned form than it might otherwise have had; indeed a combination of the most fortunate circumstances alone rendered Mt. Hurricane available. Had the base line been a particle longer southward, the Split Rock terminus would have been invisible; and had the base line been shorter, the angle would have been more acute and liable to error; had there not existed a gap in the lake shore range between the Split Rock and Trembleau mountains, just at this point on the lake, Mt. Hurricane would not have been visible from the light-houses.

In the illustration, the lower right hand portion is a horizontal plan of the triangle, showing the base line adopted, which is over twelve miles in length; and the positions of the light-houses forming the termini, with

the location of the places mentioned in the report.* The line produced north-eastward from Juniper Island light-house, shows the line of bearing of the light-house on the south end of Burlington breakwater. The final measurements upon this triangle were so simple, and had so little of the complexity and difficulty which attended the measurement of the Bald Peak angle, that no further explanation is necessary. It may be stated, however, that during the angular measurements from light-house to light-house in determining the position of Mt. Hurricane, the distance and haze, or "smoke," on one day, rendered the light-houses invisible even to the telescopes of the theodolites; and nothing could be more satisfactory and pleasing than the action of the heliostats, which, as bright, though minute specks, far distant over the waters, showed to the surveyors the location of the invisible light-house centres.

Mt. Hurricane is, for a peak of its altitude, extremely sharp in outline, and the prospect from its summit is rich and extensive. In the perspective and sectional view, the two lines radiating from the summit show the method of measurement of other peaks. The value and importance of such a peak, in securing angular measurement to lakes and mountains below, is evident.

Plate 5. *The heart of the Adirondacks.* My sketch shows the core of the region or section which should be forever preserved in its natural wilderness condition as a forest park or timber reserve for the benefit of the people of the State of New York.

This illustration is a faithful copy of one of my many topographical sketches of this region. It was taken after a laborious climb which had occupied half the day, a day of storm and gloom, of struggling over unknown ridges and through densest forests.

The names of the great mountains will be found above them, and it is hoped that this will prevent errors in nomenclature in the future. The sheer rocks and glaring slides upon the mountain sides are shown in the drawing and afford a good idea of the wildness of this range; the crest of our State.

These are the true Adirondack peaks — the central region of hypersthene rock — to which the name of Adirondack, now popularly accepted for the whole wilderness, was originally given. It is no wonder that their pre-eminence and grandeur have led to the extension of the name over the entire region. The Raquette, Saranac, St. Regis, Chautaugay, Oswegatchie, Moose river, Beaver river, Lake Pleasant and John Brown's tracts or regions, etc., are only limited sections of the woods — none of them able to hide their hills from the great Adirondack peaks — which monarch-like overtop them all, while the vast forest stretching like a sea, knows no division, cementing the whole into one immense wilderness. This, we may hope, will be the ADIRONDACK PARK or forest reserve of the State. A better or more euphonious name could not be desired.

Plate 6. *Secondary reconnaissance sketch of Mount Marcy and the most elevated lakelets or pond sources of the Hudson River.* [LATE NOTE. — Owing to my recent measurement of the height of Dudley Observatory, by which it was found to be higher than recorded in the annals of that institution, the altitudes shown upon this map (plate 6) are all above a datum $36\frac{4}{10}$ feet above mean tide level in the Hudson river at Albany. See Appendix B, p. 177.]

* The small triangles surrounding the stations — symbolizing trigonometrical points — have been engraved too large.

This is a specimen of the secondary topographical work. By means of the first survey the positions of most of the landmarks, mountain peaks, etc., are accurately platted triangularly, and an outline of the approximate topography, from the preliminary reconnaissance maps, forms a basis and guide for more exact work. The remainder of filling in between the trigonometrical points, and leveling stations of standard mercurial mountain barometers, is done with aid of hand level, aneroid, etc., as thoroughly as time permits: constant sketchings and corrections being made on the secondary sheet from the different mountain peak stations, and eventually the approximate system of contours laid out upon the map. (A specimen of a preliminary reconnaissance map of another section is given in Plate 11.) To prevent mistakes, or a misunderstanding of the rapidly made reconnaissance maps, the mountains and contours are always drawn in the field in red, and the lakes and streams in blue.

In the illustration the numbers show the altitudes of the peaks and lakes above the level of tide, and the red contour lines indicate approximate differences of elevation of a hundred feet. Wherever the red lines draw near together upon the map, the steepness of the slope increases, and where the contours run into and become merged in one another, there is a precipice; numerous minor precipices of sixty, seventy, and eighty feet occurring between the lines. Where red patches appear between the lines, are the paths of old avalanches or slides of steep, naked rock, interspersed with slight cliffs. The patches of blue show marshy or springy ground, and the blue winding lines the course of the streams. Upon the right, the rills trickling from the mountains descend to Marcy brook, which hurries down to the Ausable. Now flowing south almost to Boreas water, it turns and passes around a mountain ridge northward, into the Ausable Lake, adding its tribute to the St. Lawrence river. Upon the west, the different branches of the Opalescent river descend in a similar manner, but from a larger water-shed, and mingling flow downward to the Hudson. The two lakelets shown on the map, were for the first time reached by this survey, there being no sign or indication of previous visit, even by Indians — no mark of axe or dead-fall trap for martin — and, indeed, as the savages of old are said to have thought these desolate mountains haunted, they probably had little face-to-face acquaintance with the high peaks, where so little food or game was to be had.

The route for the new trail over the mountains, which I selected, runs directly from the old Panther Gorge Camp up the deep valley, and over the slight divide to the summit water, Lake Tear-of-the-Clouds, where the wood and water are good, and a bark wigwam will be constructed. From this point the summit of Mount Marcy can be reached in less than an hour's walk, when the tedious and hard labor of clearing a trail through the dense dwarfed timber has been accomplished. The summit of Mount Marcy has an imposing and remarkable appearance from this point. Leaving this lakelet, the future trail will either descend to the Opalescent and Lake Colden, or by a new subordinate pass, discovered west of Mount Redfield, will reach the "White lily" trail.*

* In the engraving, more prominence has been given to some of the minor summits, etc., than in the original.

The visits to these beautiful little pools, and the discovery that they really belong to the Hudson river system, are chiefly interesting as affording tangible spots or springs which we may distinguish as the most elevated pond sources of the great river of New York. Crystalline gems, margined with moss of emerald green, upheld by the granite mountains as though they were the purest offerings these Titans could make to Heaven, shut in by the strange, shaggy, half-dwarfed, evergreen forest, they are intrinsically worthy of a visit, even if they were not heads of the Hudson.

An examination of this map will show the relation which the nearer peaks have to Mt. Marcy. The Gray Peak or mountain (which on all maps has appeared disconnected and miles to the southward, and in one instance beyond the bend of Opalescent) is shown to be, in fact, an outlying peak of Marcy; a natural and suitable buttress or retaining-wall, as it were, to the great granite cathedral, whose soaring summit truly cleaves the clouds. It culminates in a long and straight ridge. Toward Marcy, a deep and irregular depression seems to separate it from the greater mountain; a causeway which, I found by dear experience in the ascent of the peak in 1872, does not facilitate exploration.

Plate 7. Altitude by barometer and telescopic levels. This illustration is a vertical section of the mountains between Mount Marcy and Mount Dix. Commencing at the right hand or east, the highest point of Mount Dix is most prominent, and immediately to the west of it the deep gorge of the Hunter's Pass; (or Gorge of the Dial;) the next defile westward, is the Elk Pass which will be seen to be higher than the Hunter's Pass; a ruler placed across the sheet from the figures at the sides affording the altitude. A sharp peak, Mount Colvin, separates the Elk Pass from the Ausable Pass, and crossing that valley, and the intermediate smaller mountains we reach Mount Haystack, now first discovered to be the third mountain in height in the State. Then the summit of Mount Marcy is seen, and the location of the little summit water lakelet — Tear-of-the-Clouds — is shown; its remarkable elevation above tide-water being made apparent. This is a portion of my vertical section across the Adirondack range; the first ever prepared. It is chiefly explanatory of the necessity of an accurate knowledge of the distance of a mountain whose height is obtained by barometrical observations upon another distant slope at its apparent level, and the need of correction for curvature of the earth and refraction. This is fully explained on page 136.

Plate 8. Blue Mountain; middle chopping rendering visible mountain peaks necessary for measurement. This was one of the clearings made by the assistant, in charge of the advance work, the view being from the top of Blue Mt. over the mass of timber, chopped away by the men in order to make visible the surrounding mountain peaks. Blue Mt., though a very central peak, has been for years a great obstacle in the way of work. Broad and massive in form, its huge bulk has been constantly found interposed between us and most important measurements, by which the distances from place to place in the wilderness could be found. At the same time its inferior altitude (3,824 feet) brought it below timber-line; consequently the whole broad, flat summit was covered with dense, heavy forest. It became necessary, however, to occupy it as a trigonometrical station, and the work was executed as detailed in the narrative. When the advanced

party reached the summit the forest interposed like a wall, and not a lake or mountain was visible.

Placing your hand before the sketch you see as much as then could be seen of the surrounding country. The assistant in command, climbing a tree, took compass bearings of the peaks and lakes to which his written orders indicated it would be necessary to measure with transit and theodolite, and shouting his commands to the men below, set the different parties of choppers at the work of clearing the intervening forest. Now carving avenues through the timber to obtain the view of some great peak — now cutting broad areas away to disclose a multitude of important points — the work progressed day after day till it was successfully executed, and Blue Mountain, from an impediment to work, had become a most important station, ready for the theodolite.

The illustration is from one of the field photographs taken on Blue Mountain by Mr. Beman, previously photographer with Col. Powell's expedition through the cañons of the Rio Colorado, in the Rocky Mountains. The value of good photographs of mountain ranges, etc., in a topographical survey, cannot be over-estimated, and I would suggest that, in all further topographical surveys by the State, provision be made for the employment of a skillful operator, one who, like the gentleman referred to, has the skill and courage to climb to the top of a lofty spruce tree, and take an "instantaneous" photograph, with aid of one hand, while hanging to the tree with the other. Had such a one been constantly at hand it would have relieved me of a vast amount of labor; for, not having among the assistants, a draughtsman whom I could intrust with the execution of drawings so important for reference, I was compelled, after finishing angular measurements, transit observations, reconnaissance maps, etc., to personally sketch, with pencil and India ink, all the views which, accumulating year after year, form a veritable panorama of the wilderness, and serve as a check and explanation in the transfer of the topography from the preliminary to the secondary reconnaissance maps. The engraving fails to show the intricate mass of limbs and tree trunks, of felled timber, which, in the photograph, and on the mountain, give an appearance of its having been swept by cannon — a storm of shot and shell — the natural forest fortifications — the breastworks of the mountain crest — stormed and captured at axe-edge; at some points a very Redan or Malakoff of ruin — the hard, gnarled, "winding," worthless timber, lying jammed together, an impenetrable *abattis*.

Plate 9. On Blue Mountain. Timber cutting for view of Snowy Mountain, and triangular measurement. This is also from one of the photographs taken on the summit, and shows an avenue out southward to obtain a view of our station of 1872, on the mountain named. The remarkably flat character of the summit of Blue Mountain is well shown, and at first sight one would hardly think that the chopping was on a mountain 3,824 feet above the sea!

The illustration shows the assistants in charge directing a party of choppers at their work. A few more trees only required cutting at the time the photograph was taken. Directly at the end of the avenue southward, the level ground of the summit suddenly pitches down at a vertical angle whose steepness is an off-set to the levelness of the summit, and further down is broken by the most formidable inaccessible

precipices, beneath which, distant in the valley, winds the trail to Indian Lake. Explorers are cautioned to refrain from attempting the descent of the mountain in this direction; the trail to Blue Mountain Lake, and our new blazed line to South Pond lead safely downwards.

Plate 10. *On Ampersand Mountain.* Adirondack survey clearing; showing below, Round Lake and part of the Upper Saranac Lake, before obscured by timber and now thrown open to measurement. This mountain is easily ascended in an hour or two from Round Lake. The view is from a sketch which I made on Ampersand mountain on the conclusion of our work at that station, October 13. Before 1873 the mountain was little known, being of inferior altitude, but having been ascended by a party from Bartletts— gentlemen and guides — the excellence of the view offered, of the Saranac Lake region, excited their admiration; a small chopping was made, to afford a lookout from the mountain, and in one place two trees which stood near together were by means of a crosspiece converted into a ladder, from which an extended view to the north-west and north was obtained. From Mt. Seward, in the first ascent in 1870, I had observed that this mountain hid Round Lake from measurement, and had regretted that its dense cornering of forest prevented its being then available; and now, upon learning of the commencement made, I determined to have a reconnaisance of the summit, and if it proved valuable, make it available by sweeping away all the forest on the main crest, if it could be done without too great expense. The ascent and result have been already detailed in the report. Our experience amid snow and ice upon the summit was painful, the more felt as we had at this time just re-entered the woods from the comforts of civilization. Our guides proceeded methodically and thoroughly to clear the mass of timber that obscured over 200° of the horizon and surrounding country from the peak, in order to afford a fair field of view for the theodolite on the solid and substantial rock of the summit. My instructions in regard to the clearing were immediately superintended by a gentleman who had volunteered as assistant, and who directed his own guide to aid in the chopping, day after day. The energy and discrimination of this gentleman were of great service, and I desire to return him my thanks. Before the axes of the men, tree after tree fell and pitched down or was thrown off the cliff, and among them was hewn down the tree ladder before mentioned, which interfered with measurements with the theodolite, to lakes seen beyond the Upper Saranac, and was indeed, no longer of any use, the whole view being laid open by our chopping, which now extended over several acres.

By dark on October 10, the guides had chopped about an acre and dragged, carried, and thrown the timber from the summit, specially opening the view from the peak toward the Upper Saranac, still to cut. A hard day's work on the 11th of October increased the size of the clearing by more than an acre, and left but little of the timber on the ridge westward to interfere with the theodolite. On the 12th we were enveloped in the clouds, but the men were kept chopping in order to have no delay in the measurement of the following day should it prove clear. The 13th being clear, another day's work completed the measurements at this station.

A sketch of the large stan-helio signal stationed here is given in plate 2. In the illustration the nearest water is Round Lake or the

Middle Saranac, with its forest covered islands, near the outlet of the Upper Saranac; beyond will be seen the old Bartlett place, so well known to hunters and anglers, and far beyond, at the horizon is seen Mt. Ma-tum-ba-la, beyond which lies Amber Lake. The name Ma-tum-ba-la is the old aboriginal title. I obtained it directly from the Indians, and now for the first time publish it as a name precedent to the common "Blue Mountain" by which the whites know it.

[LATE NOTE.—Owing to my recent measurement of the height of Dudley Observatory, by which it was found to be higher than recorded in the annals of that institution, the altitudes shown upon this map (plate 11) are all above a datum $36\frac{4}{10}$ feet above mean tide level in the Hudson river at Albany. See Appendix B, p. 177.]

Plate 11. *Specimen of preliminary reconnaissance map-sketch*, made by rapid exploration, for use in subsequent surveying operations. On such preliminary sheets every pond discovered is jotted down as near its true position as may be, and the position of its outlet and inlets noted,* the course of streams to their junction marked, and their separation to the main river systems. The approximate form and positions of the large lakes are found with prismatic compass, sextant, etc., and the general forms of the mountains and their prominent peaks and ridges sketched on. If we have noted all the important topographical characteristics of the region, we have now all the material before us and it remains to locate them in their proper positions by methodical surveying, ascertaining their distances from each other, etc., and the area which they cover—and terminating in disclosing the value of their lands—whether they are under water or on mountain summits—marshes or rugged rocks.

In the illustration are exhibited a great number of lakes which we have discovered, and which are now for the first time placed upon the map. Thirty-nine important lakes are shown with other smaller ponds, which bring the number up to 42 or 43 on this map sheet alone.

I have selected this particular reconnaissance map from the great mass of those executed, as a specimen, from its hydrographical interest, this one sheet showing a mass of lakes unknown to any guides or hunters save those heretofore mentioned. These lakes or ponds are underlined. Of the thirty-nine which are of importance, Gull Lake, Partlow Lake, and Oven Lake are the most important; the whole number of hitherto undescribed lakes and ponds now shown on this single sheet is forty-three; and there are others not shown which yet require to be located. Partlow Lake and some of the small adjacent ponds belong on the next map sheet and have been brought in to show their approximate position. The blue curved lines are used to indicate this *contraction* or on "next sheet" which is often advisable, in order while working to retain an idea of the proximity of a neighboring lake. The figures show the height of places above sea level. The lakes in blue and the mountains in red, make the illustration a perfect specimen of a preliminary reconnaissance map, as sketched in the field.

Besides Graves' mountain which was heretofore the only summit in this vicinity known to maps, five more are shown, several of which are higher than Graves' mountain, but being heavily covered with timber,

* By engraving, Bog Lake appears, erroneously, half underlined. It has been known for many years.

chiefly spruce, are unavailable for trigonometrical surveying. The Rampart mountain has been heretofore referred to in the report. The Wolf mountain was named by the trappers, as also Cat mountain; the latter being the favorite resort of the *Felis Concolor* or Cougar. Deer mountain is described in the report. Tomar's Hill obtains its name from the old Indian (whose bones lie near the Saranac) from whom I first learned years ago, of peculiarities of this region which he had obtained a glimpse of from this hill. True north is shown by the Astronomical meridian — compass card — and the magnetic variation October 30, 1873, is also indicated, as determined by my transit observation.

The latitudes and longitudes are never shown on such a preliminary sketch, being only obtained by subsequent surveying. The secondary map, though the same in substance will show changes in form, distance, etc., more approximating correctness. The latitude and longitude marked on this preliminary sheet, do not appear on the original and they are only placed in order to give an idea of the localities of the region shown. The vignette or picture in the corner exhibits the manner of marching and carrying boats.

Plate 12. *Mud Lake. Winter march westward into the unexplored region.* My sketch shows a point near our landing at the western end of Mud Lake — looking south-west. The frozen lake is snow covered and the men are seen carrying their packs and dragging their heavily laden boats as sleds. First is seen the advance guide selecting the smoothest route for the trail; then a guide drawing his boat; then a guide shouldering a theodolite pack, another drawing a loaded boat from which the legs of a tripod project, a guide carrying a pair of oars and a pack of provisions, with iron camp kettle on arm comes next, and the *assistant* steadying with one hand the barometer slung from his shoulder trudges along bringing up the rear, having an eye upon affairs ahead and seeing that nothing is lost or abandoned on the trail.

This was among the easiest of our winter marches, though the guides, after we left the ice and frozen marsh and entered the woods, had great labor at times in chopping a practicable way for the boats through the fallen timber which tangled the forest. We reached that night the Lost Lake and the shanty of the wolf trappers.

Plate 13. *Saint Lawrence County line; decaying condition of the marked trees.*

In this illustration is shown the decaying and crumbling condition of the old trees which were marked (blazed) perhaps a century ago, and now form the only line of division between the largest counties of the State. It does not, however, show the failing condition of this line; for, in order to render the sketch intelligible to the eye, the blazed marks on the trees have been made as bright and plain as when first cut.

In the field it is often almost impossible to distinguish the marks and the stakes, etc., rotted away more than half a century since. On some of the trees the marks were ingrown by the new wood years before the tree died, and now only the most practised eye can detect the difference in the bark. A seam or a wrinkle, or a streak of gum attracts our attention, and a few cuts with the axe bring to light again the "spot" or "blaze," so long hidden under the ingrowth of the wood. These lines were only run with magnetic compass, and are

often irregular when they can be found. I have had difficulty in re-tracing them with the compass.

Plate 14. *Oven Lake. Accident to the second boat; the guides, baggage and instruments in danger.*

This illustration gives some idea of the danger encountered in winter work in the wilderness. The incident has been referred to in the narrative. The delicate Saranac boat which we had brought thus far, with so much difficulty — the only one which we now had — here received fresh injuries. Crushed through by the ice below water line, the water poured in rapidly, the ice cracked from beneath the feet of the men when they attempted to lighten it, and suddenly, struggling in the deep waters of the lake, far from the shores, death seemed imminent, and would have come to men less cool and determined. Unmindful of the biting cold — freezing their garments stiff with ice, they struggled on and fought their way to shore, and I regret that there is no cross of honor to bestow upon them for their courage and tenacity, which not only saved their own lives, but the baggage, instruments, maps and records of the survey.

Plate 15. *Rocket signal. A method of approximately determining the location of new lakes in the woods.*

This mode we have tested for explorative reconnaissance and found to be useful, though not as yet able to apply it extensively. It originated, I believe, with myself, and a description of the method is given in order that it may be of use to others. During the prevalence of winds sufficient to sweep the rocket away from the vertical line it is of little value.

It is often advisable — nay, necessary — before a preliminary reconnaissance can be regarded as complete, to obtain the azimuth of the unknown points from some well-established station. The approximate distance of small lakes back in the forest may be required. If the lakes are not too distant, and the region not too mountainous, this may be effected as follows: Two transits or theodolites are stationed at known stations, a considerable distance apart — for instance, the extremities of a lake — so that a good view out over the forest in the supposed direction of the new lake may be had. Men are sent to the lake to be located, and, at a given hour of the night, rockets, which they carried shoot — a streak of fire — far upwards into the sky. Instantly the two transits, previously adjusted upon each other as zero, are turned and sighted and the second rocket waited for. Then, after observations upon many rockets, the mean angular distance is noted, and the position of the lake can be approximately platted. There are different modifications of the method, to suit different circumstances; but the principle cannot fail to be understood. The method should only be made use of in preliminary reconnaissance, and will then be found of more value if the triangles be given as nearly as possible an equilateral form, by increasing the length of the base in proportion to the supposed distance, the observers proceeding to different lakes with their transits. Care should then be taken to secure synchronous measurements upon the rockets, the time being previously agreed upon.

Tripod rockets are used, being more portable than those in common use, and quite sufficient.

In the illustration the assistants are shown engaged upon this work,

a guide holding a lantern; beyond a low range of hills is seen the rocket signal sent up by men at a distant lake.

Plate 16. *Mountain measurement* with barometer and telescopic level. This is a further explanation of the method of ascertaining the altitude of a mountain accurately by barometer without ascending it. It has been explained on page 85, of the report, but it may be well to recapitulate more briefly its purpose. The illustration shows the assistants observing on a barometer on a mountain side at the level, by sight of distant peaks. The curved lines show the effect of a curvature of the earth, and make it evident that the height of place found by sight level is not the true height of the distant mountain, but considerably less than its height. Farther up, on the open mountain side is seen the transit man at a station of apparent level, and the three lines radiating from the transit show the means by which, through trilinear surveying the position of the barometer station is accurately made known, the data thus obtained enabling us to correct the altitude of the leveling station for distance, (curvature and refraction,) and find the true height. At the foot of the mountain is seen an assistant watching the atmospheric changes, taking and recording full sets of observations at intervals of five minutes, in order to secure synchronous data for computation.

Plate 17. *Sketch in colors, showing the great land patents of the Adirondack region.*

This map is only designed to show approximate positions of the vast tracts of land granted at different times within this region by the Colonial and State governments, and is illustrative of the question of boundaries heretofore discussed. It is not designed as a map of the wilderness; but some of the mountains and larger lakes have been sketched in for the purpose of making it more intelligible. The boundary lines of these old patents and of their subdivisions, still form the only divisions of forest or timber land, and wherever the timber is accessible become of importance. So many inquiries have been addressed to me from different portions of the State, asking for information in regard to these boundaries, that I feel this explanation and explanatory map are due to the people, who cannot have access to the ancient documents, and if they had access to them, could not there find all the data collected. The map sketch shows them as they are supposed to exist, without indicating the "gores" or disputed lands which are claimed to lie between them.

In this illustration the great Macomb purchase is seen to the left or north-west in blue, the greatest tract ever granted by the State, containing, north-west of the wilderness, the most charming of lowland settlements and fertile farms; while its eastern and south-eastern portions, lying within the wilderness, are elevated and mountainous, and would be rocky and barren but for the dense primeval forest which covers nearly a million acres of its area. The red lettering upon the blue indicates the great subdivisions. These were originally six great tracts. The subsequent subdivision of great tracts, Nos. 5 and 6, are shown by titles in red letters, as Boylston's tract, Chassanis & Co., William Inman, (*the upper north-eastern portion being the present Brantingham tract,*) James Watson, and the J. J. Angerstein or John Brown's tract.

The Totten and Crossfield tract, shown by yellow, is almost entirely wilderness, the few settlements which have found a foothold within it

being merely dots upon its surface. By continuing or prolonging northward the division line between the Dartmouth and Hyde tracts, the course of base line of the Totten and Crossfield survey may be found. This was a line of mile trees (trees marked or blazed every mile and cornered) run by a surveyor named Crain or Crane, (written both ways,) and passing over the summit of Crain's Mountain — named from him — extends north-west, crossing Long Lake, etc., terminating just beyond Sperry Pond.

The great military tract is distinguished by the figure one. (**1.**) Its south-eastern corner contains portions of some of the later subdivisions, such as the Roaring Brook tract, which extends also southward over the white space to the North River tract, filling that gap.

The Moose River tract, with the other smaller patents, show the local titles of the lands over which extend other portions of the wilderness.

[NOTE. — *Errata.* The Hoffman tract should be extended over the white vacancy near it to the lake.

The southern end of the meridian 75° 30′ west has been placed in engraving about four minutes too far west, and the next three meridians eastward require slight correction.

The road shown from Elizabethtown to Keene should have been a stream (Roaring Brook), running off of the Giant Mt. The road, of course, passing just to the south of Mt. Hurricane.

A road should be shown between Keeneville and Ausable Forks, on the south side of the river, but the great mass of such minutiæ are, however, necessarily omitted, the sketch being on too small a scale. As it is, some of the names have been misinterpreted by the engraver, and in Essex county for *Tahawas* read Tahawus; for *Perck Lake* read Perch Lake; for *Keen* and *Keen Mt.* read Keene and Keene Mt; in Franklin county, *Flondwood Pond* read Floodwood Pond; and in Jefferson county for *Carthago* read Carthage.]

Plate 18. *Sketch showing the course of the survey party during* 1873. It is not intended as a map of the wilderness, but is simply a rough, outline sketch, showing the appropriate relative location of some of the principal points in the forest to which reference is made in this report. It is impossible to delineate upon so small a scale the mass of small lakes and mountain ranges, but those unacquainted with the region will gain some idea of its ruggedness and its peculiar lake system, and of the progress of the survey. It is no representation of the large, final map, which is in course of preparation on a scale of one mile to the inch, and it has not been thought advisable to hastily place upon this sketch any of the recent discoveries, as they could not be platted on so small a scale without great errors arising.

[NOTE. — *Errata.* In engraving this little sketch, the southern portions of the meridians from 74° to 75° 30′ long. have been placed about 4′ too far to the west. In Essex county the road from Elizabethtown to Keene, instead of passing to the south of Hopkins' Peak, should pass south of Mt. Hurricane. Numerous lakes and mountains are omitted on the sketch for the sake of economy, and to prevent its becoming a mere blur. Those represented are distorted by the smallness of the scale. The New York and Canada Railroad is, also, by a mistake of the engraver, represented as in operation as far north as the Boquet river. The following names, also, have been erroneously engraved:

For *Tahawas* (village in Essex county) read Tahawus.

For *Perck Lake* (Essex county) read Perch Lake.
For *Keen* (Essex county) read Keene.
For *Flondwood* Pond (Franklin county) read Floodwood Pond.
For *Carthago* (Jefferson county) read Carthage.]

Plate 19. *Sketch showing the progress of the triangulation.* [See note below.]* This is intended to give an idea of the ground work of the survey, and of the extent of country over which the triangular work has so far extended. It shows the base lines, triangles and quadrilaterals referred to in the report, and gives a good idea of their form and mathematical condition. The use of red lines to show the latest triangular work is, I think, entirely new, but it enables a direct comparison to be made between the work of the two seasons (previous year, 1872, in black lines), and admits of their both being placed upon one map sheet, which is more economical. The blue line, as explained upon the map, shows the head waters of the great rivers. This line of division of waters, was first mapped by this survey. From the summits of the mountains it descends into the deep passes only to reascend, and, as formed by the dividing ridges, extends westward, tortuously, almost to Long Lake, and eastward almost to Lake Champlain and Lake George.

Plate 20. *Sketch showing contour lines of mountains* as drawn in the field without vertical hatchings. [See note below.]* These contour lines here represent successive approximate elevation of one hundred feet, and being sketched lines — rapid approximations based on the barometrically determined altitudes of prominent points — their datum plane is a bench mark 36$\frac{4}{10}$ feet above sea level, and their highland contours are always *plus*. To the scientific this method of representing mountains is the most intelligible, and is becoming justly universal. The more nearly a map approaches the natural appearance of the country, however, the greater is its popular value, and these contours filled in, shaded and completed, as in plate 6, seem to be most readily understood. It is suggested that the legislature determine whether, in the final map of the wilderness, the mountains be thus shown, or as completed in plate 6. The colors could be dispensed with and the whole map printed simply in black.

The specimen here given still requires revision and correction from other reconnaisance maps, and reduction to scale before publication.

* [LATE NOTE. — Owing to my recent measurement of the height of the Dudley Observatory, by which it was found to be higher than recorded in the annals of that institution, the altitudes shown upon the maps (plates 6, 11, 19 and 20) are all above a datum 36 4-10 feet above mean tide level in the Hudson river at Albany. See Appendix B, p. 177.]

APPENDIX B.

CONDENSED HYPSOMETRICAL RESULTS, 1873.

REMARKS.

The following tables contain the means, and the results of the numerous field observations for barometrical leveling during the year 1873, with the mean of the synchronous readings of the instruments of the Dudley Observatory at Albany, or of the other lower stations. The complete set of field observations form two considerable volumes, and the *more valuable results* only have been with great labor reduced and condensed into the present form.

The observations are in English measures, temperature in Fahrenheit degrees. Where the instruments were stationed below the summit of a mountain, the true altitude is + the difference between the upper station and summit, which is obtained by spirit level. Where the instruments — as on a lake shore — were above the station level, the true altitude is of course minus the height of the place of observation above the level of the lake. Where the Dudley Observatory is the lower station, the height of the instrument at the Observatory must be taken into account. Its position, as given me by the officials of the Observatory, being 170 feet above the level of mean tide in the Hudson river, has been added to the computed altitude of all stations compared directly with it.*

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* The preceding remarks were already in type when I discovered that the height always accepted as the altitude of the Dudley Observatory above tide was only presumably a close estimation — the Astronomical work of the Observatory not requiring any reduction to tide. To test this question, which was raised during the progress of the map preparation, I made a rapid barometrical measurement, and found by it an altitude for the Observatory standard barometer above our tidal station of $194\frac{74}{100}$ feet. This was sufficient to show that the previously accepted height was in error, and it was therefore necessary to find the altitude accurately. Accordingly, I have had the height determined by spirit level, a continuous series being carried from the Erie canal datum (lock No. 1), at tide to the water table of the Observatory, and to the zero of the cistern of the Fastré standard barometer. The altitude from our barometrical lower station (also lock No. 1), as determined by spirit level, is $199.^{941}$ feet, and the true altitude now determined is $206.^{406}$ feet above mean tide; or $207.^{561}$ above mean low water in the Hudson river. (The mean low water datum here accepted is that of the U. S. Engineers.) The altitude thus found for the Observatory standard was so much greater than the height which I had used in the computations, and necessitated such a general modification in the resulting altitudes, that I was unwilling to change all the figures of the tables and throughout the text without further examination. Accordingly I have carefully taken the altitude of the Observatory trigonometrically — and though a lack of reciprocal vertical angles has prevented a correction for refraction — I have found the zero of the observatory barometer, by this trigonometrical measurement, 207.554 feet above mean low water. Upon this confirmation of the other results, I determined to correct all the figures throughout the stereotype, so as to eliminate as far as possible any chance of future mistake or error. This will, I trust, justify the delay necessary in printing the report.

The following extract from my report for 1872 will render more intelligible the reasons for the employment of the Dudley Observatory as the superior lower station, in the determination of subordinate upper stations in the mountains by continuous field observations during a lengthened period, especially for lower stations; though, as shown in the chapter on hypsometry, my observations during the present season modify the theory given below.

For the more important mountains, etc., observations synchronous with those taken on the summit were made at near lower stations of established altitude. In the computation of all the altitudes, however, the observations at upper stations have been directly compared with the records of the truly wonderful and invaluable automatic instruments of the Dudley Observatory. It is my impression that this survey is the first in which the recording barometer, working day and night with mechanical precision, has been made the principal lower station, or station of record and correction. The position of the Observatory, directly south of the wilderness, has made it a most valuable station for correction in hypsometric work in that region.

Prof. George W. Hough, late Director of the Dudley Observatory, "has ably shown (Annals Dudley Observatory, vol. ii, pp. 234, 235), that the maxima and minima of atmospheric pressure occur contemporaneously along the same longitude, and also that the 'local disturbance (viz., within the radius of one mile), may at any instant amount to ± 0.02 of an inch."

The field observations during this season corroborate in a remarkable manner these important conclusions, and seem to prove that for ordinary engineering purposes — or purposes of exploration at least — such a lower station, though distant, is sufficient. Only during sudden storms is there danger of great error, and that measurement is to be the most valued in which there is the least indication of local disturbance. I have reason to believe that altitude observations taken upon mountain summits are more reliable than those taken in the valleys.

The almost simultaneous rise and fall of the barometer at the Dudley Observatory. and at some of our stations in the heart of the forest, are truly remarkable, and have made it probable that upon the same meridian, in fair, settled weather, if the time of observation were given by telegraph, so as to be absolutely synchronous, the barometrical curves would be very similar.

The computation of the altitudes from the field observations have been generally made as heretofore, by the formula of Laplace, as adapted to English measures in the meteorological volume of the Smithsonian Institution. Another formula, slightly different in its elements — one often used by topographical or military surveyors — has occasionally been employed, when the first formula was not at hand. In accordance with request made, I here give an outline of the 1*st*, and a full computation by the 2*d* formula, trusting that they will satisfy the popular and general interest now shown in this State in regard to the use of the barometer in leveling, and afford amateurs of topographical field work the data for hypsometrical investigations.

FIRST FORMULA.

In this —

$$\left.\begin{array}{l} h = \text{the observed height of the barometer} \\ \tau = \text{the temperature of the barometer} \\ t = \text{the temperature of the air} \end{array}\right\} \text{at the lower station.}$$

$$\left.\begin{array}{l} h' = \text{the observed height of the barometer} \\ \tau' = \text{the temperature of the barometer} \\ t' = \text{the temperature of the air} \end{array}\right\} \text{at the upper station.}$$

Now calling

Z = the difference of level between the two barometers.

z = approximate values of Z as found by second factor of formula.

L = the mean latitude of the two stations.

H = the height of the barometer at the upper station, reduced to the temperature of the barometer of the lower station; or

$H = h' \{1 + 0.00008967 (\tau - \tau')\}$;

Also, the expansion of the mercurial column in barometer tube, measured by a brass scale, for 1° Fah. = 0.00008967;

Also, the increase of gravity from the equator to the poles = 0.00520048, or 0.00260 to the 45° of latitude;

Also, the earth's mean radius = 20,886,860 feet.

Then Laplace's formula reads

$$Z = \log \frac{h}{H} \times 60158 \cdot 6 \text{ English feet} \left\{ \begin{array}{l} \left(1 + \frac{t + t' - 64}{900}\right) \\ (1 + 0.00260 \cos. 2\,L) \\ \left(1 + \frac{z + 52252}{20886860} + \frac{h}{10443430}\right) \end{array} \right\}$$

SECOND FORMULA.*

In this —

H = height of mercury in barometer
T = temperature of mercury in barometer
t = temperature of the air
} at lower station.

h' = height of mercury in barometer
T' = temperature of mercury in barometer
t' = temperature of the air
} at upper station.

h = reduced height of mercury.

L = the mean latitude.

X = approximate altitude.

X' = second approximate altitude, &c.

S = height of lower station above the sea.

The complete formula then is —

$$\text{Ht.} = 60159 (\log. H - \log. h) \left\{ \begin{array}{l} \left(1 + \frac{t + t' - 64}{900}\right), \\ (1 + 0.00265 \cos. 2\,L), \\ \left(1 + \frac{x' + 52251}{20888629} + \frac{S}{10444315}\right) \end{array} \right\}*$$

Reduced height of mercury = h.

$$h = h' + 0 \cdot 00009 (T - T') h'.$$

Explanatory computation by this formula.

Altitude of **Basin Mountain** from data of August 27th, 1873, by level from Mt. Haystack; lower station Panther Gorge, $\frac{3}{4}$ of a mile (horizontally) distant from upper station.

Data:

Lower station (Panther Gorge) mean height above tide level + 3,342$\frac{31}{100}$ feet.

Correction for telescopic leveling (curvature and refraction) for distance .... + 1$\frac{75}{100}$ feet. Stations near latitude N. 44°.

---

* See note page 182.

Then—

$H = 26{\cdot}805$
$T = 57^\circ{\cdot}87$ Fah. } Lower station.
$t = 56^\circ{\cdot}50$ Fah.

And

$h' = 25{\cdot}373$
$T' = 55^\circ{\cdot}0$ Fah. } Upper station.
$t' = 56^\circ{\cdot}0$ Fah.

(A.) $h = h' + 0{\cdot}00009\ (T - T')\ h' = 25{\cdot}379$ or arithmetically

[1]

$$\begin{array}{rl} T = & 57^\circ{\cdot}87 \\ -T' = & 55^\circ{\cdot}00 \\ \hline \text{Difference,} & 2^\circ{\cdot}87 = \Delta \end{array}$$

[2]

$$\begin{array}{r} h' = 25{\cdot}373 \\ 2{\cdot}87 \\ \hline 1\ 77611 \\ 20\ 2984 \\ 50\ 746 \\ \hline 72.82051 \end{array}$$

[3]

$$\begin{array}{r} 72{\cdot}82051 \\ {\cdot}00009 \\ \hline 0{\cdot}0065538459 \end{array}$$

[4]

$$\begin{array}{r} 0{\cdot}0065538459 \\ 25{\cdot}373 \\ \hline 25{\cdot}379 = h \end{array}$$

which equals the reduced or corrected height of the mercury.

(B) 60159 (log. H — log. h); = $1{,}428\frac{29}{100}$ feet.

[1]

$$\begin{array}{rr} \text{log. } H = & 1{\cdot}428216 \\ \text{log.} - h = & -1{\cdot}404474 \\ \hline & {\cdot}023742 \end{array}$$

[2]

$$\begin{array}{r} {\cdot}023742 \\ 60159 \\ \hline 213678 \\ 1\ 18710 \\ 2\ 3742 \\ 142\ 4520 \\ \hline 1428.294978 = X \end{array}$$

X = approximate difference in height = $1{,}428\frac{29}{100}$ feet.

(C.) $X \times \frac{t + t' - 64}{900} + X = 1505\frac{25}{100}$ feet $= X'$

[1]

$$\begin{array}{rl} t = & 56^\circ{\cdot}5 \\ +t' = & +\ 56{\cdot} \\ \hline & \frac{112{\cdot}5}{2} = 56{\cdot}25 \end{array}$$

[2] $56{\cdot}24 - 32 = 24{\cdot}25$

[3]

$$\begin{array}{r} 1428.29 \\ 24.25 \\ \hline 71\ 4145 \\ 285\ 658 \\ 5713\ 16 \\ 28565\ 8 \\ \hline 34636.0325(76{\cdot}96 \\ 3636 \\ \hline 436.0 \\ \hline 3103 \end{array}$$

[4]

$$\begin{array}{r} X = 1428{\cdot}29 \\ 76{\cdot}96 \\ \hline 1505{\cdot}25 = X' \end{array}$$

X′ = second approximate difference in altitude = $1505\frac{25}{100}$ feet.

(D) $X' \times 0{\cdot}00265 \cos. 2\,L + X' = + 0{\cdot}139$ or $+ \frac{14}{100}$ feet.

This correction is minus for all latitudes north of 45°, and plus for all south thereof; or at the equator + 0·00265, at 45° *zero*; at the pole — 0·00265. In the Adirondack region it is always additive — as it is indeed throughout the whole State; and as lat. 45° is neared it becomes less and less appreciable.

In making the computation by the formula, care should be taken that the proper symbol ± of cos. 2 L be used.

In the present example

$X' \times 0{\cdot}00265 \cos. 2\,L$ may be read

$$1505{\cdot}25 \times \overline{\cos. 2 \text{ lat.} \times 0{\cdot}00265} = 1505{\cdot}25 \times \overline{0{\cdot}03490 \times 0{\cdot}00265}$$

```
[1]      .03490              [2]     .0000924850
         .00265                          1505.25
        -------                     ------------
          17450                         46242 50
         20940                         184970 0
         6980                          4624250
      ----------                      46242500
      .0000924850                     924850
                                   ---------------
                                   0.139213046250
```

```
[3]      1505.25
            .139 = (nearly 0.14) = corrections for latitude—
      -----------
         1505.390 = X''
```

X'' = third approximate altitude = $1505\frac{39}{100}$ feet.

(E) $\frac{X + 52251}{20888629} + \frac{S}{10444315} = + \cdot 4\frac{24}{100}$

These corrections are always additive.

```
[1]                                  [2]
 X'' = 1505.39                 20888629)78656132.89(3.76
        522 51                          62665887
       --------                         ----------
       1505 39                          15992245.8
      75269 5                           14622040.3
     301078                             ----------
    301078                               1370265.59
   752695
   -----------
   78658132.89                 [3]       1505.39
                                            3.76
                                         -------
                                         1509.15 = X'''
```

$S = 3{,}342{\cdot}31 \div 10444315 \times X''' = 0{\cdot}48$

```
[4]
          10444315)3342.3100(.00032
                   3133 2945
                   ---------
                   20901550
                   20888630
                   --------
                      12920
```

[5]

$X''' = 1509.15$
$.00032$

301830
452745

$0\cdot4829280$ = correction for height of lower station.
$1509\cdot15$

$1509\cdot63$ = last approximate altitude.

Now — Last approximate altitude...........	1,509·63
For telescopic level (curve. and refraction)	1·75
For elevation of lower station, above tide level...........................	3,378.71
Complete altitude Basin Mt., by level, etc.,	4 890.09 feet.

The following is the computation of the same data, by the first formula in a condensed form, for comparison:

Panther Gorge, $\beta = 26\cdot805$	τ 57°.87	t 56°.5	25760·8
Basin Mount., $\beta = 25\cdot373$	$-\tau'$ —55°.0	$-t'$ —56°.0	24326·4
	2.87	112.5	1434.4
		4.85	
		$\tau - \tau' =$	—6.7
		D =	1427·7

$$\frac{D \times (t + t' - 64)}{900} = +\ 76\cdot92$$

1427.7
48.5

7138 5
114116
57108

69233.45(76·92
6233

833 4

23 45

5 45

1504·62
·14
3·90
·35

1,509·01

Altitude Panther Gorge station,	+ 3,378·71
Curvature and refraction,	+ 1·75
Complete altitude Basin Mt. by this formula,	= 4,889·47 feet.
Compare with previous computation,	= 4,890·09 feet.
Difference,	= $0\cdot\frac{62}{100}$ of a foot.

It will be remembered that the formulæ differ slightly in some of their co-efficients, which explains the slight difference in results.*

* If we accept Bessel's results (*Astronomish Nachrichten*, No. 438), the mean radius of the Earth would be 20,888,627.15 feet, which would make the last factor in this formula $= \left(1 + \frac{z'\ 522\ 52}{20888627\cdot15} + \frac{s}{10444313\cdot57}\right)$.

CONDENSED DATA

AND

RESULTS OF CALCULATION IN HYPSOMETRY.

BY VERPLANCK COLVIN.

ELIZABETHTOWN.

BOUQUET RIVER, *July* 16, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

FIELD OBSERVATIONS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
29.531″	68°.83	68°.16 Fah.	—.001	29.749″	72°.30 Fah.

Result of calculation.— Altitude above tide, 456.69 feet.

LITTLE MOUNT DISCOVERY.

By level from Mount Discovery, July 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

FIELD OBSERVATIONS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.533	60°.5	58°.0 Fah.	—.019	29.678	64°.9 Fah.

Result of calculation.— Altitude above tide, 1,339.10 feet.

MOUNT DISCOVERY.

Summit, July 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

SUMMIT MOUNT DISCOVERY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.305	56°.96	56°.57 Fah.	—.019	29.670	63°.55 Fah.

Result of calculation.— Altitude above tide, 1,546.30 feet.

* All the altitudes hereafter given require the correction for height of the Dudley Observatory indicated on page 177.

RAVEN HILL.

Summit, July 19, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

RAVEN HILL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.881″	58°.07	58°.57 Fah.	+.011	29.671″	59°.50 Fah.

Result of calculation.—Altitude above tide, 1,964.84 feet.

RAVEN HILL.

Summit + 2 feet, July 21, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

RAVEN HILL + 2 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.065	71°.53	69°.26 Fah.	+.022	29.794	77°.17 Fah.

Result of calculation.—Altitude above tide, 1,991.76 feet.

COBBLE HILL.

By level, July 21, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

COBBLE HILL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.158	69°.50	70°.00 Fah.	+.022	29.802	75°.8 Fah.

Result of calculation.—Altitude above tide, 1,887.31 feet.

HURRICANE MOUNTAIN.

July 21, 1873.

(Bar. No. 1987.) Mean of forty-nine observations. (Mercurial.)

HURRICANE MOUNTAIN + 10 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.343	58°.0	58°.06 Fah.	+.022	29.797	76°.5 Fah.

Result of calculation.—Altitude above tide, 3,726.92 feet.

SYNCHRONOUS OBSERVATIONS ON HURRICANE MOUNTAIN WITH RAVEN HILL.

July 21, 1873.

(Mer. B, No. 1866 on Raven Hill). (Mer. B, No. 1987 on Hurricane.)

RAVEN HILL.			HURRICANE MOUNTAIN.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Alt'd Ther.	Det'd Ther.
28.066″	74°.00	71°.00 Fah.	26.339″	62°.00	62°.5 Fah.

Result of calculation. — Altitude summit of Hurricane Mountain above summit of Raven Hill, 1,781.10 feet.

BOUQUET RIVER LEVEL.

ELIZABETHTOWN, *July* 22, 1873.

(Bar. No. 1866.) Mean of seven observations. (Mercurial.)

BOUQUET RIVER LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
29.785	82°.17	81°.53 Fah.	+.022	29.958	75°.7 Fah.

Result of calculation. — Altitude of the station by this measurement above tide, 462.78 feet.

WOOD HILL.

July 22, 1873.

(Bar. No. 1987.) Mean of thirteen observations. (Mercurial.)

WOOD HILL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.993	86°.69	87°.92 Fah.	+.022	29.837	84°.1 Fah.

Result of calculation. — Altitude above tide, 1,155.20 feet.

OBSERVATIONS ON HURRICANE MOUNTAIN WITH WOOD HILL.

July 22, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

WOOD HILL.			HURRICANE MOUNTAIN + 10 feet.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Alt'd Ther.	Det'd Ther.
28.997″	87°.08	88°.14 Fah.	28.544″	75°.08	70°.16 Fah.

Result of calcutation.—Altitude of Hurricane Mountain above Wood Hill, 2,587.22 feet.

MOUNT HURRICANE.

July 22, 1873.

(Bar. No. 1866.) Mean of eleven observations. (Mercurial.)

MOUNT HURRICANE + 10 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.537	69°.77	67°.54 Fah.	+.023	29.833	84°.66 Fah.

Result of calculation.—Computed altitude above tide, 3,644.27 feet. On 22d inst., atmosphere too much disturbed for accurate results.

COBBLE HILL.

On summit, July 23, 1873.

(Bar. No. 1866.) Mean of twelve observations. (Mercurial.)

COBBLE HILL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barometer.	Temp. Air.
28.083	81°.00	80°.00 Fah.		29.878	88°.1 Fah.

Result of calculation.—Altitude above tide, 1,899.97 feet.

Station No 1. KEENE FLATTS (S. BEEDE'S).

August 12, 1873.

(Bar. No. 1987.) Mean of thirty-two observations. (Mercurial.)

FIELD STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.899″	62°.22	62°.86 Fah.		29.885″	81°.1 Fah.

Result of calculation.—Altitude above tide, 1,204.20 feet.

Station No. 2. KEENE FLATTS (PHELP'S).

August 12, 1873.

(Bar. No. 1866.) Mean of seven observations. (Mercurial.)

FIELD STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
29.163	68°.28	67°.0 Fah.		29.885	81°.1 Fah.

Result of calculation.—Altitude of station above tide, 963.46 feet.

SYNCHRONOUS OBSERVATIONS FOR DIFFERENCE OF LEVEL OF STATIONS AT KEENE FLATTS.

August 12, 1873.

PHELPS'.			BEEDE'S.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Alt'd Ther.	Det'd Ther.
29.163	68°.3	67°.0 Fah.	28.906	62°.9	63°.87 Fah.

Result of calculation.—Beede's above Phelp's, 191.24 feet.

Station No 3. KEENE FLATTS (DIBBLE PLACE).

August 13, 1873.

(Bar. No. 1987.) Mean of twenty-eight selected observations. (Mercurial.)

FIELD STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
29.247	70°.60	71°.23 Fah.		29.926	75°.6 Fah.

Result of calculation.—Altitude of station above tide, 926.66 feet.

Station No. 3. KEENE FLATTS (DIBBLE PLACE).

August 13, 1873.

(Bar. No. 1987.) Mean of twenty-six observations. (Mercurial.)

FIELD STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
29.246″	70°.73]	71°.36 Fah.		29.926″	75°30 Fah.

Result of calculation.—Altitude of station above tide, 926.96 feet.

HOPKINS PEAK.

August 13, 1873.

(Bar. No. 1866.) Mean of thirteen observations. (Mercurial.)

HOPKINS PEAK.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.056	62°.26	60°.8 Fah.	000	29.926	76°.02 Fah.

Result of calculation.—Altitude above tide, 3,101.55 feet.

SYNCHRONOUS OBSERVATIONS ON HOPKINS PEAK WITH DUDLEY OBSERVATORY AND STATION NO. 3.

August 13, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

HOPKINS PEAK.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.052	59°.5	58°.5 Fah.	000	29.923	76°.75 Fah.

Result of calculation.—Altitude of Hopkins Peak above tide, 3,089.30 feet.

Station No. 3. KEENE FLATTS WITH DUDLEY OBSERVATORY.

Synchronous with Hopkins Peak.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

KEENE FLATTS STATION No. 3.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
29.250	70°.00	70°.75 Fah.	000	29.923	76°.75 Fah.

Result of calculation.—Apparent altitude by this comparison, 916.64 feet, showing local depression at time equal to — 10.17 feet $\Delta = 2$ feet.

SYNCHRONOUS OBSERVATIONS ON HOPKINS PEAK WITH K. F. STATION NO. 3, FOR ALTITUDE ABOVE KEENE FLATTS.

August 13, 1873.

(Mercurial. Bar. No. 1866.) (Mercurial. Bar. No. 1987.)

HOPKINS PEAK.			LOWER STATION KEENE FLATTS.			
Barom.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom.	Att'd Ther.	Det'd Ther.
27.052″	59°.5	58°.5 Fah.	000	29.250″	70°.00	70°.75 Fah.

Result of calculation.—Altitude Hopkins Peak above Keene Flatts (Station No. 3), 2,168.11 feet.

GIANT OF THE VALLEY MOUNTAIN.

Summit, August 13, 1873.

(Bar. No. 1866.) Mean of five observations. (Mercurial.)

GIANT OF THE VALLEY—Summit.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.622	49°.1	46°.7 Fah.	000	29.923	67°.6 Fah.

Result of calcutation.—Altitude of mountain above tide, 4,493.95 feet; above Station No. 1, Keene Flatts, 3,566.99 feet.

ROUND MOUNTAIN NOTCH.

August 16, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

ROUND MOUNTAIN NOTCH.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barometer.	Temp. Air.
27.414	62°.25	63°.0 Fah.	+.027	29.698	77°.3 Fah.

Result of calculation.—Altitude of station above tide, 2,510.03 feet.

SOURCES OF THE BOUQUET RIVER FORD, UPLAND VALLEY.

August 16, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

BOUQUET RIVER.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.474	65°.60	66°.0 Fah.	+.027	29.593	83°.9 Fah.

Result of calculation.—Altitude above tide, 2,389.05 feet.

CAMELS HUMP MOUNTAIN.

By level from Mount Dix, August 17, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

FIELD OBSERVATIONS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.608"	51°.0	51°.5 Fah.	+.027	29.966"	63°.2 Fah.

Result of calculation.—Altitude of Camels Hump (+ 9.15 corr'n curv. and refraction), 3,511.98 feet.

NIPPLE TOP MOUNTAIN.

By level from Mount Dix, August 17, 1873.

(Bar. No. 1987.) Mean of four observations. (Mercurial.)

FIELD OBSERVATIONS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.605	56°.25	55°.50 Fah.	+.027	29.975	67°.57 Fah.

Result of calculation.—Altitude of mountain above tide, 4,620.19 feet.

MOUNT DIX.

Summit, August 17, 1873.

(Bar. No. 1987.) Mean of forty-six observations. (Mercurial.)

MOUNT DIX + 3 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.425	61°.44	61°.74 Fah.	+.027	29.948	71°.82 Fah.

Result of calculation.—Altitude of Mt. Dix above tide, 4,879.61 feet.

THE HUNTERS PASS.

August 18, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

THE HUNTERS PASS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.979	56°.00	56°.25 Fah.	+.018	30.023	65°.82 Fah.

Result of calculation.—Altitudo summit of Pass, 3,211.33 feet.

DYKE BROOK FALLS CROSSING.

August 18, 1873.

(Bar. No. 1987.) Mean of seven observations. (Mercurial.)

DYKE BROOK — 10 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.355″	55°.93	56°.57 Fah.	+.018	29.945″	65°.2 Fah.

Result of calculation. — Altitude of station above tide, 2,752.42 feet.

NIPPLE TOP MOUNTAIN.

On summit, August 19, 1873.

(Bar. No. 1987.) Mean of twenty-five selected observations. (Mercurial.)

NIPPLE TOP.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.518	55°.76	56°.50 Fah.	000	29.840	77°.4 Fah.

Result of calculation. — Altitude of summit above tide, 4,684.25 feet.

FAIRY LADDER FALLS.

August 20, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

FOOT OF THE FALLS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.093	58°.62	60°.37 Fah.	000	29.959	72°.1 Fah.

Result of calculation. — Altitude foot of Falls above tide, 3,111.00 feet.

MOUNT COLVIN.

Summit, August 20, 1873.

(Bar. No. 1987.) Mean of thirteen observations. (Mercurial.)

MOUNT COLVIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.169	70°.03	68°.03 Fah.	000	29.910	82°.55 Fah.

Result of calculation. — Altitude of mountain above tide, 4,105.60 feet.

THE ELK PASS.

August 20, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

THE ELK PASS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.900″	63°.25	61°.50 Fah.	000	29.910″	83°.1 Fah.

Result of calculation.—Altitude of summit of Pass above tide, 3,266.32 feet.

CHAPEL POND.

August 21, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

CHAPEL POND (at water level).			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.614	71°.0	72°.0 Fah.	000	29.967	76°.4 Fah.

Result of calculation.—Altitude of Chapel Pond above tide, 1,594.10 feet.

Station No 1. KEENE FLATTS (*Beede's*).

Synchronous with Chapel Pond, August 21, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

KEENE FLATTS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.929	76°.37	77°.43 Fah.	000	29.967	76°.4 Fah.

Result of calculation.—Apparent altitude station above tide, 1,279.62 feet.

Station No 1. KEENE FLATTS WITH CHAPEL POND.

August 21, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

CHAPEL POND.			KEEN FLATTS.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Alt'd Ther.	Det'd Ther.
28.614''	71°.0	72°.0 Fah.	28.929''	78°.37	77°.43 Fah.

Result of calculation. — Altitude Chapel Pond above Station No. 1, Keene Flatts, 310.61 feet.

UPPER AU SABLE LAKE.

August 22, 1873.

(Bar. No. 1987.) Mean of thirty-seven observations. (Mercurial.)

AU SABLE LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.120	78°.68	80°.83 Fah.	000	29.855	81°.5 Fah.

Result of calculation. — Altitude above tide, 2,028.22 feet.

ELK LAKE.

August 22, 1873.

(Bar. No. 1866.) Mean of thirty-seven observations. (Mercurial.)

ELK LAKE LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.148	85°.21	81°.28 Fah.	000	29.855	81°.5 Fah.

Result of calculation. — Altitude above tide, 2,020.35 feet.

UPPER AU SABLE DIRECT WITH ELK LAKE.

(Bar. No. 1987.) Mean of thirty-seven observations at each (Mercurial.)

ELK LAKE (Mud Pond).			UPPER AU SABLE LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Alt'd Ther.	Det'd Ther.
28.148	85°.21	81°.28 Fah.	28.120	78°.68	80°.83 Fah.

Result of calculation.— Au Sable Lake above Elk Lake, 11.86 feet.

UPPER BOREAS LAKE.

August 22, 1873.

(Aneroid Barom.) Mean of observations. (No. 2.)

UPPER BOREAS POND (Aneroid).					
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.720"	(R. 32°)	77°.5 Fah.			

Result of calculation.—Data wanting.

UPPER AU SABLE LAKE WITH UPPER BOREAS LAKE.

August 22, 1873.

(Aneroid Barom.) Mean of observations. (No. 2.)

UPPER BOREAS LAKE.			UPPER AU SABLE LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
27.720	(R. 32°)	77°.5 Fah.			

Result of calculation.—Data wanting.

BOREAS PASS.

Divide between Au Sable and Boreas branch of Hudson.

August 22, 1873.

DIVIDE BOREAS PASS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.675	(R. 32°)	64° Fah.			

Result of calculation.—Data wanting.

BARTLETT MOUNTAIN.

August 23, 1873,

(Bar. No. 1987.) Mean of observations. (Mercurial.)

BARTLETT MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.356	50°.5	51°.5 Fah.	000	29.830	78°.0 Fah.

Result of calculation.—Altitude above tide, 3,678.35 feet.

BARTLETT MOUNTAIN.

Same date and time by mercurial barometer, No. 1866.

BARTLETT MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.358″	52°.5	51°.0 Fah.	000	29.830″	73°.0 Fah.

Result of calculation.—Altitude above tide, 3,679.48 feet.

Bench mark. PANTHER GORGE STATION.

August 24, 1873.

(Bar. No. 1866.) Mean of seventy-three observations. (Mercurial.)

PANTHER GORGE, mean h′ = 3,342.21 ft.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.729	60°.67	57°.23 Fah.	000	29.855	57°.9 Fah.

Result of calculation.—"Day altitude" of station above tide, 3,304.53 feet, being the first day of observations for determination of mean altitude of Panther Gorge as a lower station for subsequent work.

The mean altitude of the lower station established in Panther Gorge, determined by observations continued from August 23d to August 28th, being the result of one hundred and ninety-seven complete sets of selected observations, i. e., 197 readings of the barometers at the station at different times, and 394 readings of the thermometers, attached and detached.

Complete mean altitude Panther Gorge Station above tide, 3,342.31 feet. (3,378.71)

APPROXIMATE HEIGHT MOUNT HOFFMAN BY LEVEL.

Station foot of slide on Mt. Marcy, August 24, 1873.

(Bar. No. 1987.) (Mercurial.)

LEVEL OF MT. HOFFMAN — 193.15 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.141	55°.0	56°.0 Fah.	000	29.889	54°.9 Fah.

Result of calculation.—Approximate height of Mt. Hoffman, by above, 3,691.38 feet.

STATION FOOT OF SLIDE, MOUNT MARCY.

August 24, 1873.

FOOT OF SLIDE ON MT. MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.141″	55°.0	56°.0 Fah.	000	29.889″	54°.9 Fah.

Result of calculation.—Altitude above tide, 3,883.53 feet.

MACOMB'S MOUNTAIN.

By level from Mount Marcy, August 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

LEVEL OF MACOMB'S MOUNTAIN + 68 feet for curv. and refraction.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.794	51°.5	50°.5 Fah.	000	29.856	56°.7 Fah.

Result of calculation.—Altitude of Macomb's mountain above tide (+ 68 feet), 4,301.29 feet, or + 105·80 = 4,407·09 feet.*

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE STATION FOR MACOMB'S MOUNTAIN.

August 24, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.744	65°.41	60°.91 Fah.	000	29.856	56°.7 Fah.

Result of calculation.—"Time altitude," Station Panther Gorge bench mark by this, 3,308.75 feet, showing local depression equivalent to 33.56 feet (+).

Macomb's mountain, 4,334.85 feet.

* NOTE.—In the next half a dozen computations, the result has been corrected for height of the Dudley Observatory, and for mean local pressure (= × 105·80 feet).

LEVEL OF GRAY PEAK FROM MOUNT MARCY.

On slide, August 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

GRAY PEAK (+ 57′ for curv. and refrac.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.276″	59°.0	59°.0 Fah.	000	29.814″	61°.12 Fah.

Result of calculation. — Apparent altitude of Gray Peak above tide, 4,834.29 feet, or + 105·80=4,935.09 feet.

PANTHER GORGE.

Synchronous with the Gray Peak observations.

(Bar. No. 1866.) (Mercurial.)

PANTHER GORGE. Mean, 3,342.31 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.711	63°.12	60°.25 Fah.	000	29.814	61°.12 Fah.

Result of calculation. — "Time altitude" of Panther Gorge, 3,310.36 feet, showing local depression equivalent to 31.95 feet (+).

Gray Peak, 4,866.24 feet.

SOUTH PEAK OF MOUNT MACINTYRE.

By level from Mount Marcy, August 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

SOUTH PEAK OF MOUNT MACINTYRE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.208	54°.0	52°.0 Fah.	000	29.814	61°.5 Fah.

Result of calculation. — Apparent altitude above tide, 4,877.74 feet.

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE STATION WITH SOUTH PEAK OF MACINTYRE.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE. Mean h = 3,342.31 ft.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.713″	64°.75	61°.75 Fah.	000	29.814″	61°.5 Fah.

Result of calculation.—"Time altitude" Panther Gorge Station 3,318.66 feet, showing local depression equivalent to 23.65 feet (+).

Complete altitude above tide, of south peak of Mt. MacIntyre, 4.901.39 feet. (The record of this measurement is obscure and rather dubious.)

LEVEL OF MOUNT DIX FROM MT. MARCY.

August 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

LEVEL MOUNT DIX.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.251	52°.00	54°.00 Fah.	000	29.813	62°.5 Fah.

Result of calculation.—Apparent altitude of Mt. Dix by level, above tide, 4,853.91 feet, or + 105·80 = 4,959·71 feet.

SYNCHRONOUS OBSERVATIONS FOR MT. DIX, AT STATION IN PANTHER GORGE.

(Bar. No. 1866.) (Mercurial.)

PANTHER GORGE mean h = 3,342.31 ft.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.716	63°.75	58°.25 Fah.	000	29.813	62°.5 Fah.

Result of calculation.—"Time altitude" Panther Gorge Station, 3,331.15 feet, showing local depression equivalent to 11.16 feet (+).

Mt. Dix by level, above tide, 4,865.07 feet.

MT. SKYLIGHT.

BY BAROMETER AND LEVEL ON MT. MARCY.

August 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

SKYLIGHT MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.164″	49°.00	49°.00 Fah.	000	29.807″	64°.05 Fah.

Result of calculation.—Apparent altitude above tide level, 4,891.28 feet, or +105·80=4,997·08 feet.

SYNCHRONOUS OBSERVATIONS FOR MOUNT SKYLIGHT, AT STATION IN PANTHER GORGE.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE mean h = 3,342.31 ft.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.714	61°.00	56°.75 Fah.	000	29.807	64°.05 Fah.

Result of calculation.—"Time altitude" Panther Gorge above tide, 3,288.50 feet, showing local depression equivalent to 53.81 feet (+).

Mt. Skylight, 4,945.09 feet.

MOUNT HAYSTACK.

BY BAROMETER AND LEVEL FROM MT. MARCY.

August 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT HAYSTACK + 1′.40.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.135	45°.0	45°.5 Fah.	000	29.808	65°.6 Fah.

Result of calculation.—Apparent altitude of Mt. Haystack above tide, 4,900.28 feet, or +105·80=5,006·08 feet.

SYNCHRONOUS OBSERVATION AT PANTHER GORGE FOR MOUNT HAYSTACK.

August 24, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.702″	54°.12	51°.75 Fah.	000	29.808″	65°.6 Fah.

Result of calculation.—"Time altitude" Panther Gorge Station, 3,272.91 feet, showing local depression equivalent to 69.40 feet (+).

Mt. Haystack above tide, 4,969.68 feet.

MOUNT MACINTYRE, BY LEVEL FROM MT. MARCY.

August 24, 1873.

Bar. No. 1987.) Mean of observations. (Mercurial.)

LEVEL OF MOUNT MACINTYRE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.043	46°.5	46°.5 Fah.	000	29.801	61°.5 Fah.

Result of calculation.—First apparent altitude of Mt. MacIntyre, 5,000.38 feet, or + 105·80 = 5,106·18 feet.

"Time altitude" of Panther Gorge Station, 3,280.90 feet, showing local depression equivalent to 61.41 feet (+).

MOUNT MARCY.

Station on Summit (+ 8 feet), *August* 24, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.70	45°.5	45°.5 Fah.	000	29.796	66°.4 Fah.

Result of calculation.—Apparent altitude by this data above tide, 5,298.46 feet, showing local depression equivalent to 67.79 feet (+),
Or + 105·80 = 5,404·26 feet.

MOUNT MARCY.

Station A. On summit (+ 8 *feet*), *August* 25, 1873: *taken in sunshine.*

(Bar. No. 1866.) Mean of nineteen selected observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.748″	67°.17	68°.08 Fah.	000	29.670″	75°.3 Fah.

Result of calculation.—Apparent altitude above tide, 5,412.56 feet.

MOUNT MARCY, NORTH END OF SUMMIT.

Station B. August 25, 1873 (+ 9 *feet*, 6 *inches*).

(Bar. No. 1987.) Mean of nineteen observations. (Mercurial.)

MOUNT MARCY, + 9 ft., 6 in.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.714	55°.11	54°.53 Fah.	000	29.670	75°.3 Fah.

Result of calculation.—Apparent altitude of Mt. Marcy above tide, 5,381.08 feet.

Local excess from mean h., 15.83 feet.

MOUNT MARCY, SOUTH END OF SUMMIT.

Station A. August 25, 1873 (+ 8 *feet*).

(Bar. No. 1866.) Mean of seventy-three observations. (Mercurial).

MOUNT MARCY (B)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.712	61°.65	58°.55 Fah.	000	29.645	74°.74 Fah.

Result of calculation.—Apparent altitude of Mt. Marcy above tide, 5,388.80 feet.

Local excess from mean h., 22.55 feet.

MOUNT MARCY.

Station B. *On summit* (+ 9.50 *feet*), *August* 25, 1873.

(Bar. No. 1987.) Mean of thirty-seven selected observations. (Mercurial.)

MOUNT MARCY + 9 feet 6 inches.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.674″	59°.86	56°.93 Fah.	000	29.621″	74°.22 Fah.

Result of calculation.—Apparent altitude above tide, computed from the above, 5,359.64 feet.

MOUNT MARCY.

Station A. *On summit* (+ 8 *feet*), *August* 25, 1873.

(Bar. No. 1866.) Mean of thirty-seven observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.699	59°.51	56°.93 Fah.	000	29.621	74°.22 Fah.

Result of calculation.—Apparent altitude above tide, 5,363.39 feet.

LITTLE MT. HAYSTACK.

By level from Mount Marcy, August 25, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

LITTLE HAYSTACK MOUNT. + 1.572 ft.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.339	73°.00	65°.00 Fah.	000	29.740	73°.35 Fah.

Result of calculation.—Altitude of Little Haystack above tide, 4,818.31 feet.

MOUNT HAYSTACK.

Ten feet below exact summit, August 26, 1873.

(Bar. No. 1866.) Mean of forty-four selected observations. (Mercurial.)

MOUNT HAYSTACK (+ 10 feet.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.059	49°.71	48°.42 Fah.	000	29.647	76°.14 Fah.

Result of calculation.—Apparent altitude above tide, 4,912.12 feet.

(See next table.)

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE STATION FOR MOUNT HAYSTACK.

(Same date.)

(Barometer.) Mean of observations. (Aneroid.)

PANTHER GORGE (Aneroid.)			DUDLEY OBSERVATORY.		
Corr'n B ±	Barometer.	Temp. Air.	Corr'n B ±	Barom., 32°	Temp. Air.
+.326	26.575″	55°.9 Fah.	000	29.647″	76°.14 Fah.

Result of calculation.—"Time altitude," Panther Gorge Station, 3,284.10 feet, showing local depression equivalent to 58.21 feet (+).

Complete altitude Mt. Haystack by this computation, 4,970.33 feet.

BASIN MOUNTAIN.

By level from Mount Haystack, August 27, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

BASIN MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.373	55°.0	56°.0 Fah.	000	29.878	74°.15 Fah.

Result of calculation.—Apparent altitude above tide, 4,826.54 feet.

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE STATION FOR BASIN MOUNTAIN.

August 27, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.806	57°.87	56°.50 Fah.	000	29.878	74°.15 Fah.

Result of calculation.—"Time altitude" Panther Gorge, Station, 3,299.71 feet, showing local depression equivalent to 42.60 feet (+).

Complete altitude Basin Mountain above tide, 4,869.14 feet.

GOTHIC MOUNTAIN.

By level from side of Haystack Mountain, August 27, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

GOTHIC MOUNTAIN (+ 8.75 feet.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.467″	58°.50	58°.50 Fah.	000	29.878′	74°.25 Fah.

Result of calculation.—Apparent altitude of Gothic Mountain above tide, 4,707.75 feet.

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE STATION FOR GOTHIC MOUNTAIN.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

STATION PANTHER GORGE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.803	58°.0	55°.12 Fah.	000	29.878	74°.25 Fah.

Result of calculation.—"Time altitude" Panther Gorge Station, 3,288.49 feet, showing a local depression equivalent to 53.82 feet (+).

Complete altitude Gothic Mountain above tide, 4,761.57 feet.

MOUNT SKYLIGHT.

August 28, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT SKYLIGHT ON SUMMIT.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.479	69°.12	68°.62 Fah.	000	30.057	75°.07 Fah.

Result of calculation.—Apparent altitude above tide, 4,977.61 feet.

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE STATION FOR MOUNT SKYLIGHT.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.956″	71°.62	72°.87 Fah.	000	30.057″	75°.07 Fah.

Result of calcutation.—"Time altitude" Panther Gorge Station, 3,388.69 feet. Showing a local excess of pressure equivalent to 46.38 feet (—).

Complete altitude Mount Skylight above tide, 4,931.23 feet.

OBSERVATIONS AT PANTHER GOGRE STATION FOR LOWER STATION.

At Station, August 27, 1873.

(Bar. No. 1866.) Mean of sixty-nine observations. (Mercurial.)

PANTHER GORGE STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.794	65°.41	68°.01 Fah.	000	29.883	72°.87 Fah.

Result of calculation.—"Time altitude" Panther Gorge Station, 3,341.44 feet. Showing a local depression equivalent to 0.87 feet (+).

PANTHER GORGE.

At Station, August 28, 1873.

(Bar. No. 1866.) Mean of fifty-five observations. (Mercurial.)

PANTHER GORGE STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.954	72°.52	72°.25 Fah.	000	30.040	76°.32 Fah.

Result of calculation.—"Time altitude" Panther George Station, 3,380.96 feet.

Above mean altitude, 48.65 feet (—).

MOUNT REDFIELD.

By barometer and level from side Skylight Mountain, August 28, 1873,

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT REDFIELD.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.791″	73°.5	72°.5 Fah.	000	30.018″	77°.1 Fah.

Result of calculation.— Apparent altitude above tide, 4,631.91 feet.

SYNCHRONOUS OBSERVATIONS AT PANTHER GORGE FOR MOUNT REDFIELD.

August 28, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

PANTHER GORGE STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.954	65°.0	65°.5 Fah.	000	30.018	77°.1 Fah.

Result of calculation.—"Time altitude" of Panther Gorge Station, 3,322.42 feet. Showing local depression equivalent to 19.89 feet (+).

Complete altitude of Mt. Redfield above tide, 4,651.80 feet.

MOSS LAKE.

August 28, 1873,

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOSS LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.097	70°.0	65°.75 Fah.	000	30.020	77°.0 Fah.

Result of calculation.— Apparent altitude, 4,256.93 feet above tide. Correction for local depression, 19.89 feet (+).

Complete altitude of Moss Lake above tide, 4,275.82 feet.

LAKE TEAR-OF-THE-CLOUDS, OR SUMMIT WATER.

August 28, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

TEAR OF THE CLOUDS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.087″	64°.0	58°.5 Fah.	000	30.022″	76°.4 Fah.

Result of calculation.—Tear-of-the-Clouds direct with D. O., altitude above tide, 4,275.91 feet; or with the Mt. Redfield co-efficient (+ 19.89).

Mean altitude the lake above tide, 4,295.86 feet.

MOUNT MARCY.

August 29, 1873.

(Bar. No. 1987.) Mean of forty observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.071	60°.66	60°.06 Fah.	000	30.056	77°.5 Fah.

Result of calculation.—Altitude of Mt. Marcy above mean tide in Hudson river, 5,382.95 feet.

CALAMITY POND.

August 30, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

CALAMITY POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.472	80°.0	79°.5 Fah.	+.002	29.850	83°.7 Fah.

Result of calculation.—Altitude of Calamity Pond above tide, 2,709.59 feet.

SYNCHRONOUS OBSERVATIONS AT LAKE COLDEN FOR CALAMITY POND.

August 30, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

LAKE COLDEN LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.368″	67°.0	67°.0 Fah.	+.002	29.850″	83°.7 Fah.

Result of calculation.—Apparent altitude of Lake Colden above tide, 2,753.89 feet.

Lake Colden indicated to be 44.30 feet higher than Calamity Pond.

AVALANCHE LAKE.

August 30, 1873.

(Bar. No. 1866.) Mean of eight observations. (Mercurial.)

AVALANCHE LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.323	72°.37	70°.40 Fah.	+.002	29.909	79°.23 Fah.

Result of calculations.—Avalanche Lake above tide, 2,866.25 feet.

SYNCHRONOUS OBSERVATIONS AT LAKE COLDEN FOR AVALANCHE LAKE.

August 30, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

LAKE COLDEN LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.410	69°.68	70°.00 Fah.	+.002	29.909	79°.23 Fah.

Result of calculation.—Lake Colden above tide level, 2,767.58 feet.
Difference of level indicated, 98.67 feet.

AVALANCHE LAKE WITH LAKE COLDEN.

August 30, 1873.

(Mercurial. Bar. No. 1866.) Mean of observations. (Mercurial. Bar. No. 1987.)

AVALANCHE LAKE LEVEL.			LAKE COLDEN LEVEL.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
27.323″	72°.37	70°40. Fah.	27.410″	69°.68	70°.00 Fah.

Result of calculation. — Altitude of Avalanche Lake above Lake Colden, 85.57 feet.

CALAMITY POND.

September 1, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

CALAMITY POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.004	60°.25	60°.12 Fah.	+.034	29.528	77°.3 Fah.

Result of calculation. — Apparent altitude Calamity Pond by last observation, 2,772.42 feet.

SYNCHRONOUS OBSERVATIONS AT LAKE COLDEN FOR CALAMITY POND.

September 1, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

LAKE COLDEN LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.939	61°.37	60°.37 Fah.	+.034	29.528	77°.3 Fah.

Result of calculation. — Apparent altitude of Lake Colden by last observation, 2,846.26 feet.

Calamity Pond below Lake Colden by this direct comparison with the Dudley Observatory, 73.84 feet.

CALAMITY POND AND LAKE COLDEN.

Synchronous observations, September 1, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

CALAMITY POND LEVEL.			LAKE COLDEN.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
27.000″	60°.0	60°.0 Fah.	26.934″	61° 00	60°.5 Fah.

Result of calculation.—Calamity Pond below Lake Colden, 72.41 feet.

MOUNT MARCY.

September 2, 1873.

(Bar. No. 1866.) Mean of eight observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.565	45°.81	44°.12 Fah.	+.034	29.664	70°.6 Fah.

Result of calculation.—"Time altitude," of Mt. Marcy by foregoing observations, 5,424.39 feet.

Showing a local excess of pressure equivalent to 58.14 feet (+).

MOUNT MACINTYRE.

September 2, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT MACINTYRE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.813	46°.83	46°.50 Fah.	+.034	29.666	71°.16 Fah.

Result of calculation.—"Time altitude" Mt. MacIntyre by foregoing observations, 5,166.38 feet.

And by observations on Mount Marcy, correction for local excess (58.14), 5,108.24 feet above tide.

MOUNT MACINTYRE WITH D. O. ALONE.

September 3, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT MACINTYRE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.089″	53°.0	53°.16 Fah.	+.052	29.900″	74°.6 Fah.

Result of calculation.—Time altitude of Mt. MacIntyre above tide, 5,095.84 feet.

SYNCHRONOUS OBSERVATIONS ON MOUNT MARCY FOR ALTITUDE OF MOUNT MACINTYRE.

September 3, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.833	52°.5	50°.25 Fah.	+.052	29.891	74°.8 Fah.

Result of calculation.—Time altitude Mt. Marcy above tide, 5,408.01 feet.

Time excess above mean height, 41.76 feet.

SYNCHRONOUS OBSERVATIONS ON MOUNT MACINTYRE WITH MOUNT MARCY.

September 3, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT MACINTYRE (below top, 5 feet.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.040	55°.0	55°.25 Fah.	+.052	29.891	74°.8 Fah.

Result of calculation.—Time altitude of Mt. MacIntyre above tide, 5,207.98 feet.

The synchronous observations make syn. time altitude of Mt. Marcy 41.76 feet above mean = the true altitude of Mt. MacIntyre by these observations, 5,166.22 feet; showing Mt. Marcy above Mt. MacIntyre, 200.03 feet.

MOUNT MARCY + 14 FEET.

September 3, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MOUNT MARCY.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.869″	68°.82	68°.65 Fah.	+.052	29.874″	75°.45 Fah.

Result of calculation.—Time altitude of Mount Marcy by these observations, 5,482.58 feet.

The above apparent altitude shows an excess above mean equivalent to 116.33 feet. (I attribute this to erroneous record of temperature.)

SYNCHRONOUS OBSERVATIONS ON MOUNT MACINTYRE WITH MOUNT MARCY.

September 3, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT MACINTYRE (below top, 5 feet.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.040	55°.5	56°.0 Fah.	+.052	29.882	75°.3 Fah.

Result of calculation.—Time altitude of Mt. MacIntyre by these observations, 5,212.38 feet.

SYNCHRONOUS OBSERVATIONS ON MOUNT MARCY WITH MOUNT MACINTYRE + 14 FEET.

September 3, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MOUNT MARCY + 14 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
24.876	71°.5	69°.0 Fah.	+.052	29.882	75°.3 Fah.

Result of calculation.—Time altitude of Mt. Marcy by these observations, 5,517.58 feet, showing an excess over mean pressure equivalent to 151.83 feet. (Temperature evidently too high.)

Next we have apparent height of Mt. Marcy (5,517.58 feet) minus apparent height of Mt. MacIntyre (5,212.38 feet).

Showing Mt. Marcy to be higher than Mt. MacIntyre by 305.20 feet.

By comparison with mean height of Mt. Marcy (5,366.25 feet), the altitude of Mt. MacIntyre equals 5,061.05 feet.

SYNCHRONOUS OBSERVATIONS ON MOUNT MACINTYRE WITH LAKE COLDEN.

September 6, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MOUNT MACINTYRE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
25.109	46°.33	47°.83 Fah.	+.039	30.006	65°.1 Fah.

Result of calculation.—Time altitude of Mt. MacIntyre by these observations (+ 5 feet), 5,132.69 feet.

SYNCHRONOUS OBSERVATIONS AT LEVEL LAKE COLDEN FOR MOUNT MACINTYRE.

September 6, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

LAKE COLDEN LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.446	54°.17	52°.73 Fah.	+.039	30.006	65°.1 Fah.

Result of calculation.—Time altitude of Lake Colden level by last observation, 2,701.28 feet.

Mean altitude of Lake Colden (2,733.99 feet); time altitude (2,701,28), shows local depression equivalent to 32.71 feet.

Complete altitude of Mt. MacIntyre, 5,165.40 feet above tide.

SYNCHRONOUS OBSERVATIONS ON MOUNT MACINTYRE WITH LAKE COLDEN.

September 6, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

MT. MACINTYRE (below top, 5 feet.)			LAKE COLDEN.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
25.109	46°.33	47°.83 Fah.	27.466	54°.17	52°.73 Fah.

Result of calculation.—Mt. MacIntyre above Lake Colden, 2,432.23 feet.

CARABOO PASS.

September 7, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

CARABOO PASS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.689"	46°.5	48°.0 Fah.	+.039	30.008"	71°.38 Fah.

Result of calculation. — Altitude of Pass above tide, 3,626.14 feet.

CLEAR POND OF NORTH ELBA.

September 8, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

CLEAR POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.108	49°.0	49°.5 Fah.	+.061	30.125	62°.0 Fah.

Result of calculation.—Time altitude Clear Pond (North Elba), above tide, 2,123.09 feet.

CAMUS POND.

September 10, 1873.

(Bar's. No. 1987 and 1866.) Mean of observations. (Mercurial.)

CAMUS POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.259	65°.5	64°.75 Fah.	+.028	30.066	74°.5 Fah.

Result of calculation. — Altitude of Camus Pond above tide, 1,955.12 feet.

AMPERSAND NOTCH.

September 11, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

AMPERSAND NOTCH.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.899″	64°.00	65°.00 Fah.	+.028	29.718″	73°.0 Fah.

Result of calculation.—Altitude of the Notch above tide, 2,048.75 feet.

AMPERSAND POND.

September 12, 1873.

(Bar. No. 2.) Mean of observations. (Aneroid.)

AMPERSAND POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.660	70°.23	84°.5 Fah.	000	29.512	76°.6 Fah.

Result of calculation.—Altitude of Ampersand Pond above tide level, 2,150.27 feet.

AMPERSAND POND.

September 13, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

AMPERSAND POND LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.910	61°.0	60°.25 Fah.	000	29.759	67°.6 Fah.

Result of calculation.—Altitude of Ampersand Pond above tide, 2,042.40 feet.

LONG LAKE SETTLEMENT.

September 17, 1873.

(Bar's No. 1866 and 1987.) Mean of observations. (Mercurial.)

LONG LAKE SETTLEMENT.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.576″	51°.25	50°.0 Fah.	000	30.069″	55°.73 Fah.

Result of calculation.— Altitude of station 1,638.22 feet above mean tide.

SOUTH POND.

September 17, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

SOUTH POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.433	59°.62	57°.75 Fah.	000	30.005	61°.55 Fah.

Result of calculation.— Altitude of South Pond above mean tide, 1,733.43 feet.

SOUTH POND — 4 FEET.

September 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

SOUTH POND — 4 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.314	57°.5	58°.0 Fah.	000	29.958	59°.8 Fah.

Result of calculation.— Altitude of South Pond, 1,792.75 feet above tide.

EVERGREEN POND.

September 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

EVERGREEN POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.234″	75°.0	73°.5 Fah.	000	29.942″	64°.2 Fah.

Result of calculation.—Altitude of Evergreen Pond, 1,943.71 feet above tide.

MUD POND.

September 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MUD POND LEVEL.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.252	79°.0	77°.0 Fah.	000	29.928	66°.1 Fah.

Result of calculation.—Altitude of Mud Pond, 1,922.26 feet above tide level.

BLUE MOUNTAIN.

September 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

BLUE MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.269	58°.91	57°.22 Fah.	000	29.812	70°.85 Fah.

Result of calculation.—Time altitude of Blue Mountain above tide, 3.788.55 feet.

Snowy Mountain above Blue Mountain, 78.65 feet.

BLUE MOUNTAIN LAKE.

September 19, 1873.

(Bar. No. 1866.) Mean of fourteen observations. (Mercurial.)

BLUE MOUNTAIN LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.066″	65°.78	68°.08 Fah.	000	29.659″	65°.76 Fah.

Result of calculation.—Altitude of Blue Mountain Lake, 1,829.45 feet above tide.

MINNIE POND.

September 19, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MINNIE POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.711	68°.50	66°.5 Fah.	000	29.574	65°.65 Fah.

Result of calculation.—Altitude of Minnie Pond above tide, 2,094.78 feet.

AIDEN LAIR *β*. STATION.

East of Boreas River, Warren county, September 22, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

AIDEN LAIR STATION.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.698	65°.35	59°.85 Fah.	+.020	30.219	43°.8 Fah.

Result of calculation.—Altitude of station near Aiden Lair above tide, 1,664.16 feet.

HYPSOMETRY OF THE THIRD DIVISION OF FIELD WORK.

AMPERSAND SPRING.

Bench Mark, October 10, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

AMPERSAND SPRING B. M.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.263″	61°.16	59°.0 Fah.	000	30.012″	68°.5 Fah.

Result of calculation.—Altitude of Ampersand Spring b. m. by these observations, 2,929.67 feet above tide.

AMPERSAND MOUNTAIN.

October 10, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

AMPERSAND MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.808	57°.33	55°.18 Fah.	000	29.985	60°.36 Fah.

Result of calculation.—Time altitude of Ampersand mountain, 3,340.15 feet above tide.

AMPERSAND MOUNTAIN.

October 11, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

AMPERSAND MOUNTAIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
26.646	73°.19	71°.47 Fah.	000	29.779	57°.51 Fah.

Result of calculation.—Time altitude of Ampersand mountain above tide, 3,396.22 feet.

INLET OF ROUND LAKE OF SARANACS.

October 14, 1873.

(Bar. No. 1866.) Mean of thirteen observations. (Mercurial.)

ROUND LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.644''	54°.5	52°.44 Fah.	+.031	30.028''	64°.85 Fah.

Result of calculation.—Time altitude of Round Lake by these observations above tide, 1,534.52 feet.

UPPER SARANAC LAKE.

October 15, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

UPPER SARANAC LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Det'd Ther.
28.983	56°.0	55°.5 Fah.	+.031	30.331	51°.05 Fah.

Result of calculation.—Time altitude of Upper Saranac Lake above tide, 1,569.59 feet.

SYNCHRONOUS OBSERVATIONS AT HORSESHOE POND WITH TUPPER'S LAKE.

October 16, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

HORSESHOE POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.504	63°.2	60°.3 Fah.	+.031	30.146	42°.2 Fah.

Result of calculation.—Horseshoe Pond above tide, 1,694.40 feet.

SYNCHRONOUS OBSERVATIONS AT HORSESHOE POND WITH TUPPER'S LAKE.

October 16, 1873.

(Mercurial. Bar. No. 1987.) (Mercurial. Bar. No. 1866.)

TUPPER'S LAKE STATION.			HORSESHOE POND STATION.		
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Att'd Ther.	Det'd Ther.
28.676″	59°.87	57°.62 Fah.	28.504″	63°.2	60°.3 Fah.

Result of calculation.—Horseshoe Pond above Tupper's Lake, 158.32 feet.

OBSERVATIONS AT SECOND POND OF BOG RIVER.

October 18, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

SECOND POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.260	58°.94	57°.59 Fah.	000	29.940	59°.65 Fah.

Result of calculation.—Altitude of Second Pond above tide level, 1,837.99 feet, showing a local excess equivalent to 137.65 feet.

Mean altitude of Second Pond above tide being 1,700.34 feet.

GRAVES MOUNTAIN WITH SECOND POND.

October 18, 1873.

(Mercurial. Bar. No. 1866.) Mean of observations. (Mercurial. Bar. No. 1987.)

SECOND POND.			GRAVES' MOUNTAIN.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.237	58°.14	57°.14 Fah.	27.611	54.21	54°.57 Fah.

Result of calculation.—Altitude of Graves Mountain above Second Pond, 608.55 feet.

GRAVES POND WITH SECOND POND.

October 18, 1873.

(Mercurial. Bar. No. 1866.) Mean of observations. (Mercurial. Bar. No. 1987.)

SECOND POND.			GRAVES POND.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.231″	57°.0	56°.5 Fah.	28.166″	55°.25	55°.5 Fah.

Result of calculation.—Altitude of Graves Pond above level of Second Pond, 59.24 feet.

SECOND POND WITH SPRING POND.

October 18, 1873.

(Mercurial. Bar. No. 1866.) Mean of observations. (Mercurial. Bar. No. 1987.)

SECOND POND.			SPRING POND.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.226	57°.00	56°.50 Fah.	28.150	56.0	56°.0 Fah.

Result of calculation.—Altitude of Spring Pond above Second Pond, 72.27 feet.

SYNCHRONOUS OBSERVATIONS AT SECOND POND FOR THREE POUND POND.

October 19, 1873.

(Mercurial. Bar. No. 1866.) Mean of observations. (Mercurial. Bar. No. 1987.)

SECOND POND.			THREE POUND POND.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.244	49°.28	48°.14 Fah.	28.172	46°.28	46°.21 Fah.

Result of calculation.—Altitude of Three Pound Pond above level of Second Pond, 66.17 feet.

SECOND POND WITH DUDLEY OBSERVATORY.

October 19, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

SECOND POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.244″	49°.28	48°.14 Fah.	000	29.787″	62°.05 Fah.

Result of calculation. — Time altitude of second Pond by these observations above tide, 1,677.44 feet.

Deviation from mean equivalent to 22.90 feet.

SYNCHRONOUS OBSERVATIONS AT MUD LAKE WITH DUDLEY OBSERVATORY.

October 21, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MUD LAKE OF BOG RIVER.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.923	51°.97	50°.91 Fah.	000	29.515	57°.2 Fah.

Result of calculation. — Time altitude of Mud Lake by these observations above tide, 1,767.52 feet.

Deviation from mean equivalent to +.58.59 feet.

SYNCHRONOUS OBSERVATIONS AT LOST LAKE WITH MUD LAKE.

October 21, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

LOST LAKE.			MUD LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Att'd Ther.	Det'd Ther.
27.970	48°.0	48°.0 Fah.	27.984	47°.5	47°.0 Fah.

Result of calculation. — "Time altitude" of Lost Lake above Mud Lake, 16.00 feet.

MUD LAKE WITH DUDLEY OBSERVATORY.

October 22, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MUD LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.208″	48°.35	46°.96 Fah.	000	29.860″	54°.18 Fah.

Result of calculation.—"Time altitude" of Mud Lake above tide level, 1,761.43 feet.

Deviation from mean equivalent to +52.50 feet.

SYNCHRONOUS OBSERVATIONS AT MUD LAKE FOR GRASS POND.

October 22, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

MUD LAKE (—1 foot.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.255	48°.12	47°.63 Fah.	000	29.847	55°.67 Fah.

Result of calculation.—Time altitude of Mud Lake above tide, 1,705.68 feet.

Deviation from mean equivalent to 3.25 feet.

SYNCHRONOUS OBSERVATIONS AT GRASS POND WITH MUD LAKE.

October 22, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

GRASS POND.			MUD LAKE (—1 foot.)		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.248	46°.87	46°.0 Fah.	28.255	48°.12	47°.63 Fah.

Result of calculation.— Altitude of Grass Pond above level of Mud Lake, 5.17 feet.

Complete altitude of Grass Pond above tide, 1,714.10 feet.

LAKE COLVIN.

October 24, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

LAKE COLVIN.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.183″	44°.80	43°.80 Fah.	+.024	30.031″	58°.45 Fah.

Result of calculation.—Time altitude of Lake Colvin above tide, 1,932.86 feet.

Deviation from mean equivalent to 21.50 feet.

BEAVER MEADOW POND.

Head of this branch of Oswegatchie river.

October 24, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

BEAVER MEADOW POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.015	54°.0	51°.0 Fah.	+.024	30.012	56°.85 Fah.

Result of calculation.—Time altitude of Beaver Meadow Pond above tide, 2,114.79 feet.

Deviation from mean equivalent to 42.78 feet.

SILVER LAKE WATERS—OTTER POND.

October 24, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

OTTER POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.266	46°.87	43°.63 Fah.	+.024	30.012	56°.45 Fah.

Result of calculation.—Time altitude of Otter Pond above tide level, 1,836.07 feet.

Deviation from mean equivalent to 87.19 feet.

BAROMETER AT STATION GRAVES' MOUNTAIN 26 feet 3″ BELOW SUMMIT.

October 25, 1873.

(Bar. No. 1866.) Mean of forty-nine observations. (Mercurial.)

GRAVES' MOUNTAIN + 26 feet 3′.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.860″	46°.41	40°.44 Fah.	—.014	30.027″	50°.14 Fah.

Result of calculation.—Time altitude of Graves' Mountain above tide level, 2,251.17 feet.

Deviation from mean equivalent to 87.68 feet.

OBSERVATIONS AT GREAT CRANBERRY LAKE (—3 feet 5 inches.)

October 27, 1873.

(Bar. No. 1866.) Mean of seventy-seven observations. (Mercurial.)

GREAT CRANBERRY LAKE (—3 ft, 5 in.)			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.872	49°.11	48°.4 Fah.	000	29.214	58°.89 Fah.

Result of calculation.—Time altitude of Great Cranberry Lake above tide, 1,504.34 feet.

Deviation from mean equivalent to 0.19 feet.

SYNCHRONOUS OBSERVATIONS AT GRASSE RIVER FORD WITH GREAT CRANBERRY LAKE.

October 27, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

GRASS RIVER FORD.			GREAT CRANBERRY LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
27.980	48°.25	47°.37 Fah.	27.897	48°.37	46°.25 Fah.

Result of calculation.—Cranberry Lake Station 88.09 feet above Grasse River ford.

Complete altitude of station at Grasse River ford above tide level, 1,416.14 feet.

OBSERVATIONS AT LITTLE GULL POND OF CHAIR ROCK CREEK.

October 29, 1873.

(Bar. No. 1866.) Mean of thirteen observations. (Mercurial.)

GULL POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.029″	30°.53	29°.5 Fah.	000	29.898″	41°.9 Fah.

Result of calculation.—Time altitude of Gull Pond above tide, 1,871.44 feet.

OBSERVATIONS AT SILVER LAKE OF BOG RIVER.

October 30, 1873.

(Bar. No. 1866.) Mean of forty-nine observations. (Mercurial.)

SILVER LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.212	35°.95	33°.98 Fah.	000	30.200	40°.98 Fah.

Result of calculation.—Time altitude of Silver Lake above tide level, 1,984.93 feet.

Deviation from mean equivalent to + 38.01 feet.

OBSERVATIONS ON LONG-TOM MOUNTAIN, SYNCHRONOUS WITH SILVER LAKE.

October 30, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

LONG-TOM MOUNTAIN.			SILVER LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Der'd Ther.
27.524	29°.0	29°.0 Fah.	28.204	37°.0	36°.0 Fah.

Result of calculation.—Altitude of Long-Tom Mountain above Silver Lake, 620.96 feet.

Apparent altitude of Long-Tom Mountain above tide level, 2,567.88 feet.

MUD LAKE.

November 1, 1873.

(Bar. No. 1866.) Mean of thirty-seven observations. (Mercurial.)

MUD LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.230″	30°.16	29°.00 Fah.	000	29.969″	41°.1 Fah.

Result of calculation.—Time altitude of Mud Lake above tide, 1,741.32 feet.

Deviation from mean equivalent to 32.39 feet.

SYNCHRONOUS OBSERVATIONS AT BOG LAKE WITH MUD LAKE.

November 1, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

BOG LAKE.			MUD LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.193	29°.5	29°.5 Fah.	28.204	29°.0	28°.0 Fah.

Result of calculation.—Time altitude of Bog Lake above Mud Lake, 10.15 feet.

Altitude of Bog Lake above tide, 1,719.08 feet.

LOST LAKE.

November 2, 1873.

(Bar. No. 1866.) Mean of thirty-seven observations. (Mercurial.)

LOST LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.373	44°.23	41°.35 Fah.	000	30.137	33°.7 Fah.

Result of calculation.—Excess above mean altitude by these observations + 82.34 feet.

Complete altitude above tide, 1,724.93 feet.

OBSERVATIONS AT TAMARACK POND, SYNCHRONOUS WITH LOST LAKE STATION.

November 2, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

TAMARACK POND.			LOST LAKE STATION.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.418"	44°.83	40°.00 Fah.	28.361"	36°.0	35°.16 Fah.

Result of calculation.—Shows Tamarack Pond to be lower than Lost Lake by 33.77 feet.

Atmosphere greatly disturbed.

COW-HORN POND WITH LOST LAKE.

November 2, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

COW HORN POND.			LOST LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
28.322	37°.06	36°.33 Fah.	28.354	41°.16	38°.66 Fah.

Result of calculation.—Altitude of Cow Horn Pond above Lost Lake by above, 11.05 feet.

Altitude of Cow Horn Pond above tide, 1,735.98 feet.

CRYSTAL LAKE.

November 2, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

CRYSTAL LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.243	42°.49	38°.91 Fah.	000	29.940	49°.7 Fah.

Result of calculation.—Time altitude of Crystal Lake above tide 1,765.62 feet.

GREAT PLAINS.

November 3, 1873.

(Bar. No. 1866.) Mean of fifty-five observations. (Mercurial.)

GREAT PLAINS.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.294″	40°.29	36°.89 Fah.	000	29.821″	46°.77 Fah.

Result of calculation. — Time altitude of station above tide, 1,599.94 feet.

No correction.

WHITE POND.

November 5, 1873.

(Bar. No. 1987.) Mean of seven observations. (Mercurial.)

WHITE POND.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.405	32°.85	31°.57 Fah.	000	29.946	42°.82 Fah.

Result of calculation. — Time altitude above tide, 1,571.98 feet.

Deviation from complete altitude, 78.85 feet (+).

Complete altitude White Pond above tide, 1,650.38 feet.

OBSERVATIONS AT GULL LAKE OF GREAT PLAINS SECTION.

November 8, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

GULL LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.479	40°.04	38°.36 Fah.	000	29.405	45°.33 Fah.

Result of calculation. — Time altitude of station above tide level, 1,976.98 feet.

Deviation from mean, 5.50 feet.

OVEN LAKE.

November 8, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

OVEN LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.462″	40°.0	38°.1 Fah.	000	29.354″	46°.65 Fah.

Result of calculation.— Time altitude of station above tide level, 1,938.73 feet.

Deviation from mean undeterminable; atmosphere greatly disturbed.

CROOKED LAKE.

November 10, 1873.

(Bar. No. 1866.) Mean of thirty-seven observations. (Mercurial.)

CROOKED LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Det'd Ther.
27.743	23°.67	21°.28 Fah.	000	29.797	33°.75 Fah.

Result of calculation.— Time altitude of station above tide level, 2,000.69 feet.

Deviation from mean equivalent to + 14.62 feet.

OBSERVATIONS AT CLEAR LAKE OF THE RED HORSE CHAIN.

November 11, 1873.

(Bar. No. 1866.) Mean of eighty-five observations. (Mercurial.)

CLEAR LAKE — 35 feet.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.745	26°.21	25°.05 Fah.	000	29.834	35°.8 Fah.

Result of calculation.— Time altitude of station above tide, 2,016.40 feet.

Deviation from true altitude + 46.87 feet.

Complete altitude of Clear Lake above tide, 1,969.53 feet.

OBSERVATIONS AT NIGER LAKE WITH CLEAR LAKE.

November 11, 1873.

(Mercurial. Bar. No. 1987.) Mean of observations. (Mercurial. Bar. No. 1866.)

NIGER LAKE.			CLEAR LAKE.		
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Att'd Ther.	Det'd Ther.
27.940″	27°.5	27°.5 Fah.	27.726″	27°.0	26°.0 Fah.

Result of calculation.—Clear Lake above Niger Lake, 163.77 feet.

SALMON LAKE.

November 12, 1873.

(Bar. No. 1866.) Mean of observations. (Mercurial.)

SALMON LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.660	37°.21	36°.0 Fah.	+.006	29.820	44°.02 Fah.

Result of calculation.—Time altitude of station above tide, 1,736.17 feet.

Deviation from mean, 16.09 feet.

STILLWATER, BEAVER RIVER.

November 14, 1873.

(Bar. No. 1866.) Mean of twenty-five observations. (Mercurial.)

STILLWATER BEAVER RIVER.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
28.190	25°.62	21°.48 Fah.	+.006	29.826	25°.6 Fah.

Result of calculation.—Altitude of Stillwater on Beaver River above tide, 1,605. 26 feet.

COMPUTATION OF BEACH'S LAKE WITH OSWEGO.

November 18, 1873, 12 *h.*, 8 *m.*, P. M.

(Bar. No. 1866.) (Mercurial.)

BEACH'S LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.016″	28°.0	24°.0 Fah.	29.067″	27°.5 Fah.

Result of calculation.—"Time altitude" of lake above tide, 1,881.06 feet.

COMPUTATION OF BEACH'S LAKE WITH OSWEGO.

Same day at 1 P. M.

BEACH'S LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barometer.	Temp. Air.
26.978	22°.0	20°.5 Fah.	29.046	28°.12 Fah.

Result of calculation.—"Time altitude" of lake above tide, 1,877.73 feet.

Mean altitude of Beach's Lake above tide, 1,877.39 feet.

OBSERVATIONS AT RAQUETTE LAKE.

Taken on the ice, November 20, 1873.

(Bar. No. 1866.) Mean of thirty-five observations. (Mercurial.)

RAQUETTE LAKE.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.987	31°.11	25°.79 Fah.	000	29.666	27°.77 Fah.

Result of calculation.—Time altitude of station above tide level, 1,728.88 feet.

OBSERVATIONS AT LOWER SARANAC LAKE.

(Station 7 feet, 2 inches above ice in the Lake.)

November 27, 1873.

(Bar. No. 1987.) Mean of observations. (Mercurial.)

LOWER SARANAC LAKE, — 7 feet, 2 in.			DUDLEY OBSERVATORY.		
Barometer.	Att'd Ther.	Det'd Ther.	Corr'n B ±	Barom., 32°	Temp. Air.
27.966″	11°.11	10°.0 Fah.	000	29.584″	23°.66 Fah.

Result of calculation.— Time altitude of Lower Saranac Lake above tide level, 1,520.93 feet.

HYPSOMETRICAL COMPUTATIONS,

ON THE BASIS OF THE DATA OF THE U. S. SIGNAL SERVICE STATIONS AT OSWEGO N. Y., AND BURLINGTON, VT.

Being by the method described in the chapter on Hypsometry, only adopted in cases where great atmospheric disturbance existed along the meridian, or great local disturbance at the Dudley Observatory.

The U. S. Signal Service standard barometer was made by Adie of London, and was carefully compared with the Kew Observatory standard by the director of the London Meteorological Office. The Adirondack survey field observations require the application of —.023 for their reduction to the Washington Signal Service standard.

ROUND LAKE OF SARANAC, *October* 14, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

ROUND LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barometer, 32°	Det'd Ther.
28.647	53°.87	51°.98 Fah.	30.240	58°.75 Fah.

Result of calculation.— Altitude above tide, 1,539.75 feet.

TUPPER'S LAKE. *October* 16, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

TUPPER'S LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.678″	60°.0	56°.50 Fah.	30.221″	57°.15 Fah.

Result of calculation.—Altitude above tide, 1,517.89 feet.

CHAIN LAKES, BOG RIVER. *October* 18, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CHAIN LAKES (SECOND LAKE.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.247	59°.5	58°.0 Fah.	29.942	60°.5 Fah.

Result of calculation.—Altitude above tide, 1,687.54 feet.

CHAIN LAKES, BOG RIVER. *October* 18, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CHAIN LAKES (SECOND LAKE.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.234	57°.0	56°.50 Fah.	29.987	60°.25 Fah.

Result of calculation.—Altitude above tide, 1,686.36 feet.

CHAIN LAKES, BOG RIVER. *October* 18, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CHAIN LAKES (SECOND LAKE.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.231	59°.0	58°.0 Fah.	29.977	60° Fah.

Result of calculation.—Altitude above tide, 1,683.34 feet.

SECOND LAKE ON BOG RIVER. *October* 19, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

SECOND POND.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.233	48°.0	48°.0 Fah.	30.020	49°.5 Fah.

Result of calculation.—Altitude above tide, 1,744.14 feet.

MUD LAKE. *October* 21, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.902	52°.5	51°.0 Fah.	29.643	58°.5 Fah.

Result of calculation.—Altitude above tide, 1,720.27 feet.

MUD LAKE. *October* 21, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.946	52°.5	51°.0 Fah.	29.704	56°.5 Fah.

Result of calculation.—Altitude above tide, 1,724.92 feet.

MUD LAKE. *October* 21, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.973	48°.5	47°.5 Fah.	29.749	55°.0 Fah.

Result of calculation.—Altitude above tide, 1,723.10 feet.

LEVEL OF MUD LAKE. *October* 22, 1873, 12 M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE (—1 foot.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.207″	50°.0	48°.5 Fah.	29.974″	55°.5 Fah.

Result of calculation.—Time altitude of station above tide, 1,705.59 feet.

LEVEL OF MUD LAKE. *October* 22, 1873, 4 h. 43 m. P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE (—1 foot.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.249	48°.5	48° Fah.	30.006	56°.5 Fah.

Result of calculation.—Time altitude of station above tide, 1,688.61 feet.

LEVEL OF OTTER POND. *October* 24, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

OTTER POND.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.260	45°.0	48°.5 Fah.	30.268	46°.8

Result of calculation.—Altitude above tide, 1,923.26 feet.

LEVEL OF LAKE COLVIN. *October* 24, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

LAKE COLVIN.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.186″	45°.0	43°.6 Fah.	30.270″	48°.5 Fah.

Result of calculation.—Barometer at upper station, 4 feet above lake.

Altitude above tide, 1,954.56 feet.

LEVEL OF BEAVER MEADOW POND. *October* 24, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

BEAVER MEADOW POND.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.015	54°.0	51°.0 Fah.	30.266	48°.25 Fah.

Result of calculation.—Apparent highest pond source of Oswegatchie river.

Altitude above tide, 2,157.51 feet.

GRAVES' MOUNTAIN AND SECOND POND. *October* 25, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

GRAVES' MOUNTAIN.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.871	43°.0	41°.5 Fah.	30.307	46°.5 Fah.

Result of calculation.—Altitude of Graves' Mountain above tide, 2,306.28 feet. (Graves' Mountain above Second Pond, 608.55 feet.)

Second Pond above tide, 1,697.73 feet.

LEVEL OF GREAT CRANBERRY LAKE. *October* 27, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CRANBERRY LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.842″	50°.0	49°.0 Fah.	29.353″	53°.5 Fah.

Result of calculation.—Barometer at Cranberry Lake, 3.5 feet above water; and barometer below mean = + 20.33 feet.

Altitude above tide, 1,504.73 feet.

LEVEL OF GREAT CRANBERRY LAKE. *October* 27, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CRANBERRY LAKE — 3.5 feet.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.899	50°.0	47°.0 Fah.	29.398	52°.5 Fah.

Result of calculation.—Barometer at Cranberry Lake, 3.5 feet above water level; time excess altitude = 17.5 feet.

Altitude above tide, 1,507.66 feet.

LITTLE GULL POND. *October* 29, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

LITTLE GULL POND.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Der'd Ther.
28.019	35°.0	31°.0 Fah.	30.040	39°.5 Fah.

Result of calculation.—Altitude above tide, 1,844.57 feet.

LITTLE GULL POND. *October* 29, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

LITTLE GULL POND.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.019″	35°.0	31°.0 Fah.	30.049″	39°.43 Fah.

Result of calculation. — Altitude above tide, 1,852.37 feet.

SILVER LAKE. *October* 30, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

SILVER LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.224	32°.5	60°.5 Fah.	30.377	39°.0 Fah.

Result of calculation. — Altitude above tide, 1,932.81 feet.

LEVEL OF SILVER LAKE. *October* 30, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

SILVER LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.213	36°.0	34°.0 Fah.	30.351	41°.0 Fah.

Result of calculation. — Altitude above tide, 1,947.34 feet.

LEVEL OF SILVER LAKE. *October* 30, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

SILVER LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
28.212	36°.0	34°.0 Fah.	30.357	40°.5 Fah.

Result of calculation. — Altitude above tide, 1,951.53 feet.

MUD LAKE, 12 M. *November* 1, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE (—1 foot.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.210″	30°.0	29°.0 Fah.	30.097″	39° Fah.

Result of calculation.—Time altitude above tide, 1,697.95 feet. Atmosphere disturbed.

LEVEL OF MUD LAKE. *November* 1, 1873, 2 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

MUD LAKE (—1 foot.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.263	33°.0	31°.0 Fah.	30.134	41° Fah.

Result of calculation.—Time altitude above tide, 1,702.42 feet.

LEVEL OF CRYSTAL LAKE. *November* 2, 1873.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CRYSTAL LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.237	41°.5	36°.5 Fah.	29.979	49°.0 Fah.

Result of calculation.—Time altitude above tide, 1,627.05 feet.

GREAT PLAINS. *November* 3, 1873, 2 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

GREAT PLAINS.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.336	37°.5	35°.0 Fah.	30.064	36°.75 Fah.

Result of calculation.—Time altitude above tide, 1,576.88 feet.

GREAT PLAINS. *November* 3, 1873, 12 M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

GREAT PLAINS.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.256″	42°.0	40°.0 Fah.	29.993″	41°.0 Fah.

Result of calculation.—Time altitude above tide, 1,627.30 feet.

WHITE POND. *November* 5, 1873, 2 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

WHITE POND.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barometer, 32°	Temp. Air.
28.410	31°.0	31°.0 Fah.	30.260	33°.0 Fah.

Result of calculation.—Time altitude above tide, 1,650.83 feet.

GULL LAKE. *November* 8, 1873, 12 M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

GULL LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.466	40°.0	40°.0 Fah.	29.583	44°.75 Fah.

Result of calculation.—Time altitude above tide, 2,009.25 feet.

OVEN LAKE. *November* 8, 1873, 3 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

OVEN LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.464	40°	38°.6 Fah.	29.583	44°.7 Fah.

Result of calculation.—Time altitude of station above tide, 2,005.81 feet.

OVEN LAKE. *November* 8, 1873, 3.30 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

OVEN LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.464″	40°.0	38°.0 Fah.	29.577″	44°.9 Fah.

Result of calculation.—Time altitude above tide, 2,001.85 feet.

CROOKED LAKE. *November* 10, 1873, 12 M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CROOKED LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.736	23°.0	21°.0 Fah.	29.993	29°.0 Fah.

Result of calculation.—Time altitude above tide, 1,996.94 feet.

CROOKED LAKE. *November* 10, 1873, 2 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CROOKED LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.739	23°.0	20°.0 Fah.	29.994	24°.25 Fah.

Result of calculation.—Time altitude above tide, 1,975.20 feet.

CLEAR LAKE. *November* 11, 1873, 2 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CLEAR LAKE (—35 feet.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.724	26°.0	25°.0 Fah.	29.968	36°.75 Fah.

Result of calculation.—Time altitude above tide, 1,962.21 feet.

CLEAR LAKE. *November* 11, 1873, 12 M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

CLEAR LAKE (– 85 feet.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.743″	26°.0	24°.0 Fah.	29.963″	36°.0 Fah.

Result of calculation.—Time altitude above tide, 1,976.85 feet.

SALMON LAKE. *November* 12, 1873, 2.30 P. M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

SALMON LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
27.660	39°.0	37°.5 Fah.	29.473	39°.42 Fah.

Result of calculation.—Time altitude above tide, 1,704.00 feet.

WARDWELL'S ON STILLWATER OF BEAVER RIVER. *November* 14, 1873, 12 M.

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

STILLWATER.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Temp. Air.
28.184	32°.0	27°.0 Fah.	30.023	26°.6 Fah.

Result of calculation.—Time altitude above tide, 1,635.24 feet.

Deviation from mean, 14.99 feet (+).

RAQUETTE LAKE. *November* 20, 1873.

(Observations taken on ice of lake.)

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

RAQUETTE LAKE.			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.931"	29°.0	24°.25 Fah.	29.872"	28°.25 Fah.

Result of calculation.—Time altitude above tide, 1,730.82 feet.

LOWER SARANAC LAKE. *November* 27, 1873.

(Reduced to the level of the ice of lake.)

Computed by mean of Synchronous Observations at Oswego, N. Y., and Burlington, Vt.

SARANAC LAKE (—7.18 feet.)			SEA LEVEL.	
Barometer.	Att'd Ther.	Det'd Ther.	Barom., 32°	Det'd Ther.
27.967	11°.5	10°.5 Fah.*	29.721	19°.25 Fah.

Result of calculation.—Time altitude above tide, 1,478.61 feet.

* This is equivalent to 26°.17 centigade (below zero). Hypsometrical field work was here concluded.

APPENDIX C.

BOUNDARIES.

As heretofore explained the names of the great land tracts are the titles of vast topographical areas and their boundaries, and are so frequently referred to as to require full explanation.

Premising that anterior to the great patents shown on the map, there were along Lake George and Lake Champlain, numerous conflicting French and English grants made at the period when the contest for supremacy of those powers upon this continent was at its height; and that the lines of those still older grants near Lake Champlain, run in every possible direction; I will proceed to give an outline account of the patents shown upon this map in the order of their area.

MACOMB'S GREAT PURCHASE.

This patent was a grant by the State of New York, made in 1791, to Alexander Macomb, a citizen, and was the largest single grant of land ever bestowed by the State. The whole patent was afterward subdivided into six great tracts, only a portion of which was ever actually issued by patent to Macomb.

The history of the purchase may be briefly outlined; the records showing what were the *actual* boundaries of the purchase.

In the minutes of the Commissioners of the Land Office for the State of New York, of 22d January, 1791, appears:

"The application of Alexander Macomb, for the purchase of the following tracts of land was read, and is in the words following, viz.:

Acres 3,635,200; £121,173 6s. 8d.

"*To the Commissioners of the Land Office of the State of New York:*

"Gentlemen.—I take the liberty of requesting to withdraw my application to your honorable board of April last, and to substitute the following proposal for the purchase of the waste and unappropriated lands, comprised within the bounds herein mentioned, and all the islands belonging to this State in front of said lands, viz.: Beginning at the north-west corner of the township called Hague, on the river St. Lawrence, and thence extending southerly along the westerly bounds of said township, and the township called Cambray, to the most southerly corner of the latter, thence extending easterly, northerly and southerly along the lines of said township of Cambray, and of the townships of De Kalb, Canton and Potsdam, and Stockholm, to the easternmost corner of the latter, thence north-westerly along the line of the said township of Stockholm, and the township of Louisville, to the river St. Lawrence, thence along the shore thereof to the line, run for the north line of this State, in the 45th degree of north latitude, thence east along the same to the west bounds of the tract formerly set apart as bounty lands for the troops of this State, serving in the army of the

United States, thence southerly along the same to the north bounds of the tract known by the name of Totten and Crossfield's purchase, thence westerly along the north bounds of the tract last mentioned to the westermost corner thereof; thence southerly along the south-westerly bounds thereof to the most westerly corner of township number five in said tract, thence westerly on a direct line to the north-westermost corner of the tracts granted to Oothoudt, thence westerly on a direct line to the mouth of Salmon River where it empties itself into Lake Ontario, thence north-easterly along the shore of said lake, and the river St. Lawrence to the place of beginning, including all the islands belonging to this State, fronting the said tract in Lake Ontario and the river St. Lawrence, five per cent. to be deducted for highways and all lakes whose area exceeds one thousand acres, to be also deducted, from which after the above deductions, I will give eight pence per acre, to be paid in the following manner, to-wit: One-sixth part of the purchase-money at the end of one year from the day on which this proposal shall be accepted, and the residue in five equal installments on the same day, in the five next succeeding years. The first payment to be secured by bond, to the satisfaction of your honorable board, and if paid on the time limited and new bonds to the satisfaction of the board executed for another sixth of the purchase-money, then I shall be entitled to a patent for one-sixth part of said tract, to be set off in a square in one of the corners thereof, and the same rule to be observed as to the payments and securities and grants or patents, until the contract shall be fully completed. But if at any time I shall think fit to anticipate the payments, in whole or in part, in that case I am to have a deduction on the sum so paid, of an interest at the rate of six per cent. per annum, for the time I shall have paid any such sum before the time hereinbefore stipulated. I have the honor to be gentlemen, with great respect your most obedient servant,"

"ALEXANDER MACOMB."

[*Interest rate* 6 *per cent.*]

(*A true copy.*)

In the month of May succeeding, Macomb seems to have found it necessary to still further amend his application and proposal by the following agreement, which was accepted by the commissioners of the land office and concluded the purchase. It reads:

"NEW YORK, *May* 2, 1791.

"I do hereby consent and agree that the islands called Carleton's or Buck's islands, in the entrance of Lake Ontario, and the Au Long Saut, in the river St. Lawrence, and a tract equal to six miles square, in the vicinity of the village of St. Regis, be excepted out of the above contract, and to remain the property of the State. Provided always, that if the said tract shall not be hereafter applied for the use of the Indians of the said village, that then the same shall be considered as included in this contract, and that I shall be entitled to a grant for the same, on my performance of the stipulations aforesaid.

"ALEXANDER MACOMB."

(*Accepted.*)

Thus Macomb secured from this State three million six hundred and thirty-five thousand and two hundred acres of land at the remarkable price of eight pence an acre. Extending through more than one and a half degrees of latitude, and two degrees of longitude, this immense tract contains lands of the most varied character; and while the farms, in the great settled regions, within its limits are now valued by the hundred dollars per acre, it is remarkable that of the vast section still remaining a wilderness, there are tracts which would still be considered dear at eight pence an acre.

The following was the original estimate of the

Contents of Macomb's Purchase.

		Acres.
(Great Tract) No. 1		821,819
2		553,020
3		458,228
4		450,950
5 }	Wm. Inman's 1st Tract	26,250
6 }	Wm. Inman's 2d Tract	74,400
	Thos. Boylston's Tract	817,155
	Peter Chassanis' Tract	220,500
	James Watson's Tract	61,433
	John Julius Angerstein	210,000
	Total	3,693,755
Deduct six miles square to be laid out at St. Regis for the Indians		23,040
		3,670,715

Associated with Macomb in this purchase, were Daniel McCormick and William Constable; the patents for Great Tracts 1, 2 and 3, were issued to McCormick, and the remainder to Macomb. Both of the latter at length failed, and William Constable, the remaining owner, and as agent, conducted the subsequent disposal of the property, and from him the remaining portion of the great purchase intact, passed by inheritance to the Pierreponts. The Chassanis' tract was purchased for wealthy and noble French emigrees, exiled by the great revolution. Most of those who settled here being unaccustomed to the hardships of such a life were discouraged, a large amount of cash invested was sunk, and the enterprise proved a failure. The first agent, Rudolf Tillier, was superseded in 1800 by Gouverneur Morris, who appointed a sub-agent, Richard Coxe.

GREAT TRACT No. 1 (*in Franklin Co.*) was primitively subdivided into twenty-seven townships, now politically represented by eleven towns in Franklin county, viz.: Constable, Westville, Bangor, Malone, Duane, Brighton, Harveststown, Brandon, Dickenson and parts of Bombay and Fort Covington. [*The twenty-seven original townships of Great Tract No.* 1, *were called:* 1, *Macomb;* 2, *Cormachus;* 3, *Constable;* 4, *Moria;* 5, *Bangor;* 6, *Malone;* 7, *Annastown;* 8, *St. Patrick;* 9, *Shelah;* 10, *Williamsville;* 11, *Westerly;* 12, *Ewerettaville;* 13, *Dayton;* 14, *Ennis;* 15, *Fowler;* 16, *John's Manor;* 17, *Gilchrist;* 18, *Brighton;* 19, *Cheltenham;* 20, *Margate;*

21, *Harrietstown*; 22, *Lough-neagh*; 23, *Killarney*; 24, *Barrymore*; 25, *Mt. Morris*, 26, *Cove Hill, and* 27, *Tipperary*.]

GREAT TRACT NO. 2 (*in St. Lawrence county*) was first subdivided into eighteen townships, which are now represented by five towns, viz.: Brasher, Lawrence, Hopkinton, Parishville and Colton. [*The eighteen original townships of Great Tract No. 2, were called*: 1, *Sherwood*; 2, *Oakham*; 3, *Atherton*; 4, *Harewood*; 5, *Janestown*; 6, *Piercefield*; 7, *Graushue*; 8, *Hollywood*; 9, *Kildare*; 10, *Matildaville*; 11, *Wick*; 12, *Riversdale*; 13, *Cookham*; 14, *Catharinesville*; 15, *Islington*; 16, *Chesterfield*; 17, *Grange*; 18, *Crumack*.]

GREAT TRACT NO. 3 (*in St. Lawrence county*) was first subdivided into fifteen townships, which have been supplanted in the county divisions of St. Lawrence county by eight towns, viz.: Hammond, Rossie, Fowler, Hermon, Edwards, Pitcairn, Russell, Fine and Pierrepont. [*The original fifteen townships were as follows*: 1, *Hammond*; 2, *Sommerville*; 3, *De Witt*; 4, *Fitz William*; 5, *Ballybeen*; 6, *Clare*; 7, *Kilkenny*; 8, *Edwards*; 9, *Sarahsburgh*; 10, *Clifton*; 11, *Pontaferry*; 12, *Scriba*; 13, *Chaumont*; 14, *Bloomfield*; 15, *Emelyville*.]

GREAT TRACT NO. 4 (*partly in Herkimer, Lewis and Jefferson counties*) was purchased by the "Antwerp Company" of Holland, for whom it was first managed by Gouverneur Morris, and subsequently by one of the principal owners, James D. Le Ray de Chaumont, by whom the western portion, on or near Lake Ontario, in Jefferson county principally — laid out in small sections — was successfully disposed of. At the east end of this tract, a triangular piece existed, in what is now the most northerly portion of Herkimer county. In Lewis county it is represented by the whole of the present town of Diana, which contains Lake Buonaparte; once the hunting camp of Joseph, the brother of Napoleon. In Jefferson county the tract reserved by the treaty of 1788, by the Oneida Indians for Peter Penet, and known as "Penet's Square," was excepted of course from Macomb's subsequent purchase, and consequently from this Great Tract, (No. 4.)

The towns in the northern portion of Jefferson county, covering the territory included in this tract, were the whole of Antwerp, Philadelphia, Teresa, Alexandria, Orleans, Clayton, Cape Vincent and Lyme; with those portions of Brownsville, Pamelia, Leray and Wilna, lying north of a line starting in Herkimer county at the north-western corner of Totten and Crossfield's purchase, running thence directly west forming the southern boundary of Diana, in Lewis county, and entering Wilna (J. co.), passing south of the village; cutting across the present town of Champion south of Great Bend; and thence through Leray, Pamelia (near Military corners) through Brownsville to the shore of Griffin Bay — of Lake Ontario, near the bend of the road on the south shore of the bay — being the dividing line between this tract and

GREAT TRACT NO. 5. This was partly in Herkimer, Lewis, Jefferson and Oswego counties. It consisted of the northern portion of the tract afterward purchased by John Julius Angerstein, which was subsequently sold (eight towns) to John Brown,* of Rhode Island, who endeavored unsuccessfully to clear a piece of his wilderness and make settlements. (His agent, Charles F. Herreshoff, committed suicide — here in the wilderness, 1819 — in despair at the failure of the enter-

* *Not* the slave liberator whose grave is near the eastern margin of this wilderness.

prise, and at the absence of iron ore, which had been claimed to exist here.) It thus came to be known as "John Brown's tract," a title often improperly extended by some hunters to the whole wilderness. Westward and north of Angerstein's tract (which lies entirely in Herkimer Co.) was the subdivision sold to James Watson (partly in Lewis and partly in Herkimer Co.), about three-quarters of which were within this great tract; (No. 5;) the remainder being south of the line and in Great Tract No. 6. Next westward was the subdivision sold to Pierre Chassanis & Co. of France in 1792, almost the whole of which lay within Great Tract No. 5, and the present county of Lewis. The remainder (of G. T. No. 5) afterward formed the northern half of Boylston's tract, obtaining its name from Thomas Boylston of Massachusetts, who owned it for a short time, though the patent was issued to Samuel Ward. Of the whole of the eleven townships of the north-western section *or first division* of the Boylston tract, 1, Hounsfield; 2, Watertown; 3, Rutland; 4, Champion; (excepting the Great Bend;) 6, Henderson; 7, Adams; 8, Rodman; represent the portion in Jefferson county; while the rest of the eleven: 5, Denmark; 9, Pinkney; 10, Harrisburgh; 11, Lowville, are in Lewis county. *The townships in the second division of Boylston's tract* are cut obliquely by the south line of the Great Tract No. 5. In Jefferson county the whole of Ellisburgh, Lorrain and Worth; in Oswego county the north portions of the towns of Richland, Sandy Creek, Boylston and Redfield; and in Lewis county, the north portions of Montague and Martinsburgh (the old 3, Shakespeare; 4, Cornelia; 5, Porcia) complete the list of towns in Great Tract No. 5. The boundary between this and the next and last Great Tract of Macomb's Great Purchase, is a line extending from a point on Totten and Crossfield's west line, about two miles south of "No. 4" (at Beaver Lake) Lewis county, to Lake Ontario near Selkirk, Richland, Oswego county.

GREAT TRACT No. 6 extended over Oswego, Lewis and Herkimer counties. In Oswego county the whole town of Orwell, the southerly portion of Sandy Creek, Boylston and Redfield, the north portions of Richland and part of Albion were within the Boylston tract. In Lewis county Osceola, Highmarket, Turin and West Turin, with the south portions of Montague and Martinsburgh, completed the Boylston tract. The Inman tract, which is wholly in Lewis county, was divided into the present "Inman's Triangle" (town of Leyden and east corner of Lewis, in said county) and into the "Brantingham tract," wherein is the well-known lake of that name, the present town of Greig representing it. The portion of the town of Watson south of the division line of Great Tracts 5 and 6 and the similar portion of the Angerstein or John Brown tract, (town of Wilmurt, Herkimer county, with part of Long Lake, Hamilton county,) seem to have been part of the Brown tract and complete the great Macomb purchase.

TOTTEN & CROSSFIELD'S PURCHASE.

The origin of this great tract, its boundaries and area as originally laid out, will be better understood by an examination of the records.

From the minutes of the council of the colonial government of 7th June, 1771, is extracted the following:

"At a council held at Fort George, in the city of New York, on Friday, the 7th day of June, 1771—

"*Present:*

"His Excellency the Right Hon. John, Earl of Dunmore, Captain-General, &c.,

"Mr. Watts,	Mr. Cruger,
Mr. Apthorp,	Mr. Wallace,
Mr. Smith,	Mr. White,

"The annexed petition was read:

"*To his Excellency, the Right Honorable John, Earl of Dunmore, Captain-General and Governor-in-chief in and over the Province of New York, and the territories depending thereon in America, Chancellor, and the Admiral of the same, in council:*

"The humble petition of Joseph Totten and Stephen Crossfield, in behalf of themselves and their associates, humbly sheweth:

"That your petitioners have discovered that there is a certain tract of land lying and being in the county of Albany, on the west side of the most northerly branch of Hudson's river, beginning at the north-east corner of a tract of forty-six thousand acres of land petitioned for by Thomas Palmer and his associates; thence running south 60° west, to the north-west corner of a tract of land petitioned for by John Bergen and his associates; thence running north 30° west, till it shall intersect a line coming west from ten miles north of Crown Point; thence east to Hudson river; thence down the said river to the north bounds of a tract of land, petitioned for by Edward Jessup and Ebenezer Jessup and their associates, of forty thousand acres; thence westerly and southerly round the said tract of land until it shall come to the north-east bounds of said tract of land petitioned for by the said Thomas Palmer and his associates, being the place of beginning.

"That the said tract of land hath not been purchased of the Indian proprietors thereof, but that the Indian right thereto still remains vested in them.

"That your petitioners and their associates are willing and desirous at their own expense, of vesting the Indian right and title to the lands before described in his Majesty, in hopes of being able to obtain his Majesty's letters patent for such parts of the said tract of land as shall be found fit for cultivation.

"Your petitioners therefore in behalf of themselves and their associates, most humbly pray your Excellency's lysence, enabling them to purchase in his Majesty's name of the Indian proprietors thereof, the tract of land before described, in order that your petitioners and their associates may be enabled to apply for and obtain his Majesty's letters patent for the same, or such parts thereof as upon an accurate survey may be found fit for cultivation, and your petitioners as in duty bound shall ever pray, etc.

"New York, April 10, 1771."

JOSEPH TOTTEN,
STEPHEN CROSSFIELD.

"In behalf of themselves and their associates."

This petition was referred to a committee of the Council, reported favorably and the permission to purchase of the Indians given.

The purchase was made in 1772 in accordance with law at Johnson Hall in the presence of Gov. Tryon, John Butler acting as interpreter. The purchase-money, paid to the Indians in the presence of the Governor, amounted to the sum of eleven hundred and thirty-five pounds, (£1,135) lawful money of New York (together with five shillings, etc., by Gov. Tryon on behalf of his most sacred Majesty, George the Third, etc.), being an absolute deed of all their interest in the tract as bounded and described in the petition of Totten and Crossfield; an estimated area of 800,000 acres. It is signed by

HENDRICKS, + Mark.
ABRAMS, + Mark.
AGWIRÆGHSSE,
JO HANS CRIM.

It is to be remarked that the commencement of the deed gives the names as Hendrick *alias* Tayahansara, Lawrence *alias* Aggurasies, Hans *alias* Canadajaure, and Hans Krine *alias* Onagoadhoge, "native Indians of the Mohock Castle."

The speculators who secured this Indian deed subsequently made application through Governor Tryon, to the Crown for a patent for the same. It had by this time become apparent, however, that the pretended desire to effect settlements upon these lands, thereby securing extraordinary privileges, was not the real object of those desiring the patent; and that the names of Totten and Crossfield, simply ship-carpenters of New York, merely served as the screen to certain famous speculators or "land jobbers" as they were then called, and the Crown officials appear to have suspected that this was a scheme to obtain possession without due consideration of the valuable timber, (majestic groves of noble white pines which at that period in all the abundance of the primeval forest crowded the banks of the Upper Hudson,) and seem to have desired that the title should be vested in more responsible persons. This was just previous to the revolution, and by the Earl of Dartmouth (letter of 21st April, 1775, to Governor Tryon) they are informed: "I shall submit to his majesty my humble opinion that "whenever the persons really, and *bona fide* interested and concerned "in those purchases shall make humble application to his majesty for "such grants, accompanied with a disavowal of all association to "obstruct the importation or exportation of goods to and from Great "Britain it may be advisable for his majesty to comply with their "request, and to confirm to them the possession of the said lands by "letters patent under the great seal of Great Britain, and not other-"wise:" being a demand for a declaration of their loyalty. The immediate occasion for this demand may perhaps be explained by the fact that subsequently Joseph Totten appears as 26th on a list of the *general committee* of the city and county of New York, chosen May 1st, 1775.

Previous to June, 1774, there had been, according to Governor Tryon, but two grants in the colony of New York made directly by the crown of Great Britain, such grants or patents having been previously made under the hand and seal of the governor of the colony.

Joseph Totten, Stephen Crossfield, and their associates having — as noticed — obtained permission, purchased at Johnson Hall of the before mentioned Mohawk Indians their title to this tract, estimated to contain 800,000 acres. In 1772 the first survey of the region with compass was commenced; just one hundred years before the State made the first appropriation in aid of the present Adirondack survey. Of the whole purchase only forty townships were originally surveyed, the remaining ten — the whole number at present being fifty — were afterward located. The survey simply consisted in running a chained line by compass on the outer lines of these townships and marking line and corner trees.

I cannot but consider uncertain and dubious the claim made by some that the northern limit of the territory of the Mohawk Indians, or a line from *Rejioghne* to the mouth of the Oswegatchie river, was intended to be the north boundary of Totten and Crossfield's Purchase. Such a line certainly never served as the boundary, and the absurdity of the idea will be better appreciated by those acquainted with the region when it is shown that — allowing Split Rock to have been the ancient *Rejioghne* of the Indians — such a line would have passed north of Whiteface mountain in Essex county, and north of Canton in St. Lawrence county; which is preposterous. On the contrary, if we accept the testimony of Sir William Johnson this line of northern limit of the Mohawk territory extended from a point on the Mohawk river sixty miles west of Schenectady, "from thence eastward and north to *Rejioghne* in Lake Champlain," which is quite another course, yet one equally at variance with the north boundary of the Totten and Crossfield Purchase.

From the original field-book of the survey, I extract the following:*

"This Book contains the Map and field Books of the townships "and lands purchased for the Crown of the Native Indians and Sur-"veyed for the proprietors in the *year* of our Lord 1772. By

"EBEN JESSUP."

"N. B. The rivers are not traversed but are found in the places "where they cross the outlines of the townships, and have their "courses in general nearly as they are laid down in the map.

"In order to avoid dispute hereafter that may arise either by the "artfull ways of designing men that would alter the Banks of the "lands as they are surveyed to other places, indevoring to put the "whole in confusion by some means, to serve themselves, or by surveys "not being carefull to do their work perfect in every respect, and by "that means some advantage may be had in law against the proprie-"tors which is Seldom neglected where there is an opportunity in "these times, and not expecting them to be any better hereafter——"I thought best to fix the place of beginning of the survey at a "natural boundary that could not be altered that the land surveyed "that are recorded in this book may remain indisputable while Rivers "run."

"I therefore began on the east bank of the Hudson River on a tract "of land about four (4) thousand acres granted to myself and others,

* A complete copy of this field book is now in my possession.

"now called Jessup's lower patent, a point to the mouth of the west "bank of Hudson river called by some Sackendaga Branch, and from "thence runs north fourteen degrees west, three hundred and eighty-"four chains and & forty links. Thence north Eight Degrees thirty "minutes, west one hundred and eighty-four chains. Thence north "Thirty-two degrees East, Three Hundred and Twenty-eight chains "and eighty links. Thence north Thirty Degrees west across the "north branch of the Hudson River and on the west bank of the Said "River marked a Beech Tree with the letters — E. E. W. E. F. and "here built a log house to Receive the Provisions Brought up in "Battoes and called it the Landing house. From this said Beech tree "which is the south west corner of a tract of land Purchased of the "native Indians For the Benefit of Edward and Ebenezer Jessup and "their associates, is a line sun north Thirty Degrees west along the "west side of the said tract of land to the north west corner thereof, "which is Ten miles on this line from the river with mile trees marked "on the line, as in the field book of Mr. Joseph Crane. This course "and line of mile trees I continued through to the north side of the "lands Purchased for the benefit of Joseph Totten and Stephen Cross-"field and their associates, and is called the line of mile trees, being "marked from " I to " LV in numeral letters, but most of them are "numbered on the map in figures—the Surveyors put the Letters E F "on most of the trees and many of them the date 1772.

"EBEN JESSUP."

In 1773, "Totten and Crossfield and their associates," now known (perhaps still privately) among themselves as the *proprietors* — some thirty in number — assembled at the house of Robert Hall, in New York, January 14, and after the transaction of business, the voting on an assessment of £4 per thousand acres for the building of a road, etc., proceeded to ballot for twenty-four of the townships. Singular to relate Stephen Crossfield still kept ahead, drawing township No. 1. Robert Hall drew No. 20, (Markham,) and Ebenezer Jessup No. 17 (Ebentown). The other numbers drawn were 2, 7, 8, 9, 10, 11, 12. 15, 16, 18, 19, 21, 22, 25, 26, 30, 32, 33, 35 and 40.

Ebenezer Jessup, in addition to his township, received, in compensation for the labor of making boundary lines of a portion, payment at the rate of £5 per thousand acres. If this rate of payment extended to the whole purchase he would have received, allowing an area of 800,000 acres, $20,000; or by the present area which is claimed for it, (1,150,000 acres,) $28,750. Large as this sum must have been at that period (A. D. 1772) it would not probably have more than sufficed to run the boundaries throughout by blazed trees; and it must always be regarded as unfortunate that permanent survey marks were not placed.

After the revolution much of this purchase reverted to the State, and was regranted or sold to individuals or companies; a large portion of it being now owned by the Adirondack Estate and Railroad Company, which has come into the possession of the 500,000 acres granted by the State to the Saratoga and Sackett's Harbor R. R. at 5 cents an acre. It is now divided into fifty townships (numbered from 1 to 50) known, generally, numerically. It was intended that each township should contain thirty-six square miles, but though possessing some degree of uniformity, and having their easterly and westerly

lines nearly parallel, they differ in area, and at times in form — subsidiary triangles being afterward numbered — such as the 50th township. The old boundaries at the north-eastern corner, also, was the Schroon or "East branch of the Hudson River," whereas the present east line of townships 48 and 49 are lines to the west of that stream, and run parallel with the other north-easterly boundaries. This being the present acceptation, I have so placed it upon the map sketch. The Totten and Crossfield purchase was never divided into "great tracts;" the townships, as numbered, being the only divisions. The purchase extends over the counties of Herkimer, Hamilton, Warren and Essex. The townships running obliquely to the county and town lines, and being numbered irregularly, it would be almost impossible to give in writing alone the location of the several townships, and the reader is therefore referred to the forthcoming map of the whole wilderness, on which these townships will be delineated in the different towns and counties.

Of the *towns* included in the Totten and Crossfield purchase in Herkimer county, about eighty square miles are in the town of Wilmurt. *In Hamilton county,* the whole of the towns of Long Lake and Gilman and nearly the whole of Wells, with the north portion of Lake Pleasant, Arrietta and Morehouseville; in *Warren County,* the whole of the present towns of Johnsburg, and the greater portion of Thurman and Chester, with the north-western portion of Stony Creek. The south-eastern boundary here commencing at a corner on the east bank of Schroon River, above the junction with Brant Lake stream, and running thence south-westerly north of Friend's Lake to the corner of Palmer's purchase.

In Essex County it extends over the whole of Newcomb, with portions of Minerva, Schroon, North Hudson and Keene.

There can be hardly a better proof than this of the great value of the permanent mountain land marks, whose position and bearings it has been my labor to locate.

GREAT OR OLD MILITARY TRACT. The large red colored area, at the right of the map, extends over portions of Franklin, Clinton and Essex counties. It contains twelve townships, having an estimated area of six hundred and forty thousand acres, and was reserved by the State of New York "for the soldiers of the line of this State, serving in the armies of the United States" in the Revolutionary War. It was not, however, conveyed. All original grants herein were therefore made by the Commissioners of the Land Office of this State.

In *Franklin County* it includes the towns of Franklin, Bellmont, Burke and Chateaugay.

In *Clinton County* the towns of Clinton and Ellenburgh, with the western portion of Dannemora, Saranac and Black Brook.

In *Essex County* the towns of St. Armand, North Elba, Wilmington, with portions of Keene (north of the Totten and Crossfield line) and portions of Elizabethtown and Jay.

MOOSE RIVER TRACT is wholly in Herkimer and Hamilton counties, and is divided into ten townships. It contains a portion of the State canal lands, the Woodhull and Bisby lake reservoirs, etc. In Hamilton county it extends across the towns of Morehouse and Arrietta, and into Lake Pleasant. In Herkimer county it is wholly in the

town of Wilmurt. It contains 140,000 acres, and is shown on the map by the red area with one dot upon it.

REFUGEE TRACT. This was a conditional grant of 231,540 acres, made by the State Legislature, May 11, 1782, to the Canadian and Nova Scotian refugees who had supported the cause of the United States during the Revolution, and were now fugitives. It was subdivided into lots, which were balloted for by 252 of the refugees. Fifteen lots, of 333⅓ acres each, were reserved and distributed by ballot to the officers and private soldiers among the fugitives. Much of the land, however, was not occupied within the time specified by the legislative act, and became again the property of the State. It is shown on the map by the green area in Clinton county.

PALMER'S PURCHASE. This lies partly in four counties. It was originally granted to Thomas Palmer, and is supposed to contain about 135,000 acres. The only interest attaching to it in this question of boundaries is the fact that its north-western line was adopted as the south-eastern line of a portion of the great Totten and Crossfield purchase. It has been subdivided into four great lots, "the State," "middle," "rear" and "river" lots. It is shown on the map by the green area east of Luzerne, marked one. Joshua Wells was its agent in 1798. Surveyed July 19, 1788, by L. Vrooman.

OXBOW TRACT lies entirely in Hamilton county. It is one of the comparatively modern tracts, and has been subdivided into 304 lots, and contains about 70,000 acres. It is shown by the green area marked two.

BENSON TRACT OR TOWNSHIP. The boundaries of this tract were marked in 1795. It was named after Egbert Benson; is divided into 373 lots, and is supposed to contain about 61,920 acres. It is wholly in Hamilton county, and is shown upon the map as a red area, with two spots upon it.

WOODHULL TRACT. This is a tract of between 39,000 and 40,000 acres, lying across the division line of Oneida and Herkimer counties, as shown on the map.

These are the only tracts which, in connection with the central and wilder portions of the region, call for particular notice, though there is not one of the remaining sections shown on the map where deer and bear are not annually hunted, which is a sufficient index to their character.

The ROARING BROOK TRACT, shown by the dark brown line cutting into the south-east corner of the old military tract, is a more modern subdivision of lots. The tract on the west side of Schroon lake, often known as the ROAD PATENT, has been called the BENTHYSEN TRACT, after the principal lot, and in order to distinguish it from the West-of-road patent near it.

The area of, and the salient facts in regard to the other tracts shown upon the map, will be obtained by an inspection of the tables attached hereto.

MACOMB'S PURCHASE.

TABLE OF PATENTS AS ISSUED.

TRACTS.	PATENTEES.	DATE OF PATENT.	Original number of acres estimated.	Probable actual number of acres.
Great Tract No. 1...	Daniel McCormick...	May 17th, 1798..........	821,819	821,879
" " No. 2...	" "	May 17th, 1798..........	553,020	553,020
" " No. 3...	" "	March 3d, 1795....... ..	458,228	640,000
" " No. 4	Alexander Macomb....	January 10th, 1792......	450,950	450,950
" " No. 5			26,250	26,250
" " No. 6			74,400	74,400
			817,155	
			220,500	1,368,400
			61,433	
			210,000	
Total area in acres,....................................			3,693,755	3,934,899

PRINCIPAL SUBORDINATE TRACTS IN MACOMB'S PURCHASE.

TRACTS.	In great tracts.	PURCHASERS.	Date of Sale.	Acres.	Counties.
Boylston's tract........	No. 5 and 6	Samuel Ward........	December 18, 1792.	817,155	Thirteen towns in Oswego, Jeffer'n & Lewis.
Black River tract or eleven towns........	No. 5 and 6	A later division of Boylston tract.....	July 15, 1795.	290,376	Eleven towns in Lewis and Jefferson.
Chassanis tract........	No. 5 and 6	Pierre Chassanis & Co.	April 12, 1793.	210,000	Jefferson and Lewis.
Brantingham tract.....	" 6	William Inman......	February 20, 1793.	74,400	Town of Greig, Lewis.
Constable's towns....	" 6	James Constable.....	....	107,520	Five towns in Lewis.
Ellisburgh........ ...	" 5	Marvel Ellis.........	March 22, 1797.	52,834	Jefferson county.
Inman's triangle.......	" 6	William Inman......	February 20, 1793.	26,250	Port Leyden south to West Leyden, Lewis.
Watson's tract.........	No. 5 and 6	James Watson.......	April, 1796.	61,433	Lewis and Herkimer.

Table of other tracts shown on sketch in colors.

TITLE.	County.	Acres.	Subdivision.	Remarks.
Totten & Crossfield's purchase	Herkimer, Hamilton, Essex & Warren.	Actual area from 1,000,000 to 1,150,000.	Fifty townships.	Originally estimated to contain 800,000 acres.
Old Military tract	Franklin, Clinton and Essex.	640,000.	Twelve large townships.	Reserved for revolutionary soldiers.
Moose River tract	Herkimer and Hamilton.	About 140,000.	Ten large townships.	Part of it canal reserve lands. The Woodhull, Bisby lakes, etc.
Palmer's purchase	Hamilton, Warren, Saratoga and Fulton.	About 135,000.	Four great lots.	State, Rear, River and Middle.
Refugee tract	Clinton.	131,420.	Numerous small lots.	Canadian and Nova Scotian refugees.
Paradox tract	Essex.	Nearly 70,000.	428 lots.	Contains Paradox lake.
Brant lake tract	Warren & Essex.	Nearly 45,000.	254 lots.	Surveyed 1803 by Geo. Webster.
Hyde tract or patent	Warren.	40,000.	90 lots.	Sept. 10, 1774, Ed. Jessup and C. Hyde.
Dartmouth patent	Saratoga and Warren.	About 47,000.	205 lots.	Patented to Jer. Van Rensselaer, Oct. 4, 1774.
Bergen's purchase	Hamilton and Fulton.	19,200.	13 lots.	Survey in 1785.
Benson tract or township	Hamilton.	About 61,920.	373 lots.	Egbert Benson.
Oxbow tract	Hamilton.	About 70,200.	304 lots.	Oxbow lake.

Lawrence tract	Hamilton.	50,000.	55 lots.	Jonathan Lawrence, contains 14 lots of Sickles, etc.
Arthurborough tract	Hamilton.	About 47,360.	190 lots.	Arthur Noble, Feb. 15, 1787.
Vrooman patent	Herkimer and Hamilton.	14,193.	52 lots.	Isaac Vrooman, 1786–90.
Woodhull tract	Oneida and Herkimer.	39 to 40,000.	54 lots.(?)	Towns of Remsen and Wilmurt.
Nobleborough patent	Herkimer.	40,960.	118 lots.	Arthur Noble, 1787.
Nobleborough patent	Herkimer.	4,480.	1 lot.	South branch reservoir.
Adgate's patent	Oneida and Herkimer.	43,907.		Mathew Adgate, 1798.
North River Head tract	Essex.	Perhaps 15 to 20,000.	140 lots.	In towns of North Hudson, Moriah, Keene & Elizabethtown.
West of Road patent	Essex.	Perhaps 30,000.	174 lots.	
"Benthuysen tract"	Essex.	About 8,000.	4 lots.	Old "Road Patent."
"Benthuysen tract"	Essex.	(1,590).	(No. 2 of the four)	Benthuysen lot.
Hoffman tract	Essex,	About 24,480.	89 lots.	Extends to Schroon lake.
St. Regis reservation	St. Lawrence & Franklin.	3,840.	6 square miles.	Reserved from Macomb.
Remsenburgh patent	Herkimer.	48,000.	99 lots. (?)	Henry Remsen and 3 others, 1787.
Jerseyfield patent	Herkimer and Fulton.	94,000.	94 lots.	Henry Glen and 93 others, in 1770.
Roaring brook tract	Essex.	About 18,560	86 lots.	Elizabethtown and Keene.

OTHER PATENTS; GRANTED BY THE ENGLISH COLONIAL GOVERNMENT.

In the several Counties of Northern New York, which are either in the wilderness or settlements adjacent thereto: annexed for reference.

TITLE.	County.	Date.	Acres.	To whom granted.
Amherst Tract	Hamilton	April 6, 1774	40,000	Sir Jeffery Amherst.
Balfour's patent	Hamilton and Warren	March 6, 1775	5,000	Henry Balfour (in T. & C. pur.)
Bishop's patent	Hamilton	April 6, 1774	14,000	Wm. Bishop (T. & C. pur.)
Campbell's patent	Essex	July 11, 1764	5,000	Allen Campbell.
Claus' patent	Fulton	Sept. 29, 1770	3,000	Daniel Claus.
Frank's patent	Herkimer	Sept. 6, 1765	5,000	Coenradt Frank, *et al.*
Friswell's patent	Clinton	May 7, 1765	3,000	John Friswell.
Grant's patent	Essex	August 17, 1764	3,000	Robert Grant.
Hasenclever's patent	Herkimer	Feb. 27, 1769	18,000	Peter Hasenclever.
Henderson's patent	Herkimer	——— 1739	6,000	James Henderson, *et al.*
Herkimer's patent	Herkimer	April 13, 1752	2,324	Joost, Johan Herkimer *et al.*
Jerseyfield patent	Herkimer and Fulton	April 12, 1770	94,000	Henry Glenn, *et al.*
Jessup's purchase	Warren	March 21, 1768	11,650	Ebenezer Jessup, *et al.*
Jessup's purchase	Warren	April 10, 1772	2,000	Ebenezer Jessup, *et al.*
Johnson's patent	Herkimer	Sept. 27, 1765	2,000	Guy Johnson.
Judd's patent	Essex	April 16, 1765	2,000	James Judd.
Kayaderosseras' patent	Saratoga and Warren	Nov. 2, 1708	———	N. Hermanse, *et al.*
Kennedy's patent	Essex	August 7, 1764	2,000	John Kennedy.
Kingsborough patent	Fulton	June 23, 1753	20,000	Arent Stevens, *et al.*
Lansing's patent	Herkimer	June 23, 1753	6,000	Jacob Lansing, *et al.*
Legge's patent	Essex	June 26, 1769	5,000	Francis Legge.
Lindsay & Livingston's patent	Herkimer	August 24, 1730	3,000	John Lindsay, Ph. Livingston.

Livingston's patent	Montgomery and Herki'er,	Feb. 10,	1762	20,000	Ph. Livingston, *et al.*
Livingston's patent	Fulton and Saratoga	Nov. 8,	1760	4,000	Ph. Livingston, *et al.*
Lyne's patent	Herkimer	Jan. 2,	1754	20,000	John Lyne, *et al.*
McIntosh's patent	Essex	August 7,	1765	3,000	Alexander McIntosh,
Markham's patent	Hamilton	April 5,	1774	5,000	Wm. Markham (T & C.).
Mayfield patent	Fulton and Hamilton	June 25,	1703	——	June 27, 1770 (one authority).
Montresor's patent	Essex	June 6,	1765	3,000	John Montresor, *et al.*
Northampton patent	Fulton	Oct. 17,	1741	6,000	Jacob Mase, *et al.*
Ord's patent	Essex	Jan, 31,	1775	5,000	Thomas Ord.
Preston patent	Hamilton	June 27,	1770	14,000	Achilles Preston, *et al.*
Queensbury patent	Warren	May 20,	1762	23,000	Daniel Prindle, *et al.*
Roberts' patent	Fulton	Sept. 29,	1770	2,000	Benjamin Roberts.
Ross' patent	Essex	April 16,	1765	2,000	James Ross.
Royal Grant,	*Herkimer*	*April* 16,	1765	93,000	Sir John Johnson.
Sacondaga patent	Fulton and Hamilton	Dec. 2,	1741	28,000	Lendert Gansevoort, *et al.*
Sherriff's patent	Warren	Oct. 18,	1775	4,000	Charles Sherriff.
Skene's patent	Essex	July 30,	1771	3,000	Philip Skene.
Small's patent	Essex	April 6,	1774	5,000	John Small.
Stoughton's patent	Essex	July 25,	1764	2,000	John Stoughton.
Sutherland's patent	Essex	August 7,	1764	3,000	Nicholas Sutherland.
Timberman's patent	Herkimer	May 30,	1755	3,000	John Timberman, *et al.*
Van Rensselaer's patent	Saratoga and Fulton	Oct. 4,	1774	28,964	Jeremiah Van Rensselaer.
Vaughan's patent	Herkimer	April 24,	1770	8,000	John Vaughan, *et al.*
Wallace's patent	Hamilton	April 11,	1770	6,365	Hugh Wallace, *et al.*
Walton's patent	Herkimer	August 12,	1768	12,000	Wm. Walton, *et al.*
Wharton's patent	Essex	April 15,	1765	3,000	John Wharton.
Winne's patent	Herkimer	Oct. 6,	1741	2,000	Peter Winne.
Wilmot's patent	Montgomery	August 29,	1735	2,000	Anne Wilmot.
Wiesberg's patent	Essex	Feb. 18,	1775	3,000	Daniel Wiesberg.

Tracts disposed of in small parcels by the Commissioners of the Land Office.

Name of Tract.	County.	Notes.
Bulwagga Bay tract...	Essex..........	4 lots granted by Com-
Essex tract..........	Essex..........	248 lots missioners of the
Hague tract.........	Warren and Ess.	62 lots Land Office.
Iron ore tract........	Essex..........	234 lots " "
Jay tract	Essex and Clin..	160 lots " "
Lake George tract....	Warren.........	93 lots " "
Lewis tract (south)...	Essex..........	33 lots " "
Luzerne tract........	Warren.........	173 lots " "
North-west Bay tract.	Essex..........	133 lots " "
Perou Bay tract......	Essex..........	130 lots " "
Roaring Brook tract..	Essex..........	86 lots " "
St. Lawrence, ten towns,	St. Lawrence..	Each 10 miles square,* sold at auction, 1½ mile lots.
Schroon tract........	Essex..........	111 lots.
Split Rock tract......	Essex..........	33 lots.
Trembleau tract......	Essex..........	17 lots.
Tongue Mt. tract.....	Warren.........	52 lots.
Warrensburgh tract ..	Warren.........	22 lots.
Whiteface Mt. tract...	Essex and Clin..	Principally N. W. of Wilmington Notch.

* Intended to be, but actually of different areas.

APPENDIX D.*

The following extracts from the report for 1872, are annexed for reference, in order that the narrative of field work may be full and complete in this report.

*   *   *   *   *   *

Since the completion of the primary geological survey of New York there has not been even an attempt at an exploration of the whole of the vast forest now known as the Adirondack Wilderness.

For almost all the exact knowledge that we possess of the topography and physical character of the region, we are indebted to Prof. Emmons and those who so ably assisted him. Through them we first learned that Whiteface Mountain, before time placed at about two and a half thousand feet above the sea, and, consequently, supposed to be far inferior in altitude to the Catskills, really overtopped, by more than a thousand feet, those more famous and familiar mountains, while, southward, towering amidst the clouds, arose a sea of summits grander and still more magnificent.

There, guarded by the mountain peaks and ridges, arose Mt. Marcy, which, by barometer, they found to be 5,467 feet above the sea; and there, hidden, lay Lakes Colden and Avalanche, long thought to be the highest bodies of water eastward of the Rocky Mountains.

This was almost the first scientific exploration of the mountains; for though the Indian and white hunters had long traversed the region, and had, even for the unvisited summits, names which many of them still retain—despite subsequent re-naming—the only recorded measurements of the mountains, on which is placed reliance, are those of Profs. Redfield, Emmons and Benedict, during the progress of the geological survey. These altitudes were all taken with mountain barometer, the last reported measurements being made in 1839, and recorded in the report, Assembly Document No. 50, for the year 1840.

The heights measured at that time were few; two mountain summits only—Mt. Marcy and Owl's Head—being recorded in the valuable report of Prof. Benedict. A few other summits were measured by other observers with the inferior instruments of the day, and to many unvisited mountains, lying in the depths of the wilderness, an estimated altitude was given by guess, more as a means of comparison than as an exact statement of their altitude.

Beyond this hypsometrical work and the taking of a few magnetic bearings of important points, no addition was made to our knowledge of the topography; nor was such a result to be expected, the labors of geology requiring undivided attention.

Since that period maps of the wilderness region have appeared, generally compiled from the notes of tourists and the statements of hunters or guides; in which the publisher has often so mistaken his in-

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* Altitudes as corrected in brackets [ ].

formant as to place some mountains in the wrong towns or counties, or (as in one instance), to make space for three large and magnificent lakes, where, in reality, but two exist; while a thousand of the most prominent features of the wilderness, cloud-clapped mountains, broad-stretching ponds and rushing streams, are totally omitted.

Previously to the granting of the appropriation for which this report is rendered, by continued exploration of my own in this wilderness, a mass of topographical material had been gathered. The general positions, names and shapes of most of the un-mapped or wrongly mapped mountains, lakes and rivers, had been ascertained, and the general character of even the hitherto unvisited portions of the country noted.

It was designed to found upon these observations a map of the wilderness more correct in its topography than any previously published, and, consequently, more useful; a contribution to the geography of a portion of the State which, as has been shown, is mathematically almost unknown.

In the endeavor to properly locate on paper, this mass of material, the gravest errors were detected, even in maps founded upon actual surveys; and the points which I had selected as topographical centers were found to be themselves undetermined. For instance, the position of Mt. Marcy, the summit and center of the Adirondack range, and the highest mountain in the State, was found to have never been established; the place of that great mountain landmark upon the maps being miles distant from its real location. Compass bearings had been found generally worthless, owing to the magnetic disturbance, peculiar to this region, and to the local attraction probably attributable to the great masses of magnetic iron ore, so abundant among the mountains.

In this condition of affairs the only resource was a triangulation of these semi-alpine mountain summits, connected with some known base. The vastness of such an undertaking, necessitating the re-traversing of so great an extent of wilderness, the ascending of numerous mountains, several of which have a perpendicular height of 5,000 feet, the labors and fatigues, the danger of exploration in the great ocean of woods, of accident and of hunger, can only be appreciated by the surveyor, who has passed through such an ordeal.

There remained, therefore, but one resource; a survey with theodolite or transit, entirely independent of the magnetic compass; the object in view being, as heretofore stated, the discovery, by trigonometrical measurement, of the relative angular position of the mountain summits, and other important landmarks, for use in the preparation of a map of the wilderness.

In addition, it was deemed advisable to organize a department of hypsometry, in order that, with the improved mountain barometers, the value of the old measurements could be ascertained, and the altitude of numerous unmeasured mountains discovered. The present survey, being necessarily rapid, would not admit of altitude determinations by trigonometry.

For the use of the very superior theodolite made by Troughton & Simms of London, and employed in effecting the primary triangulation, I am under obligation to the trustees of the Albany Academy.

The sextant was an instrument of my own, and was useful in the measurement of horizontal angles. It was also occasionally used with

artificial horizon in the approximate determination of latitude; but both the latitude and longitude of stations will be best determined by the results of the triangulation.

The mercurial mountain barometer, used at the upper stations on the mountain summits, in effecting their measurement during this season, was new, and of James Green's best construction; scale adjusted for capillarity, and vernier reading to one-thousandth of an inch.

The barometer employed at the near lower station for corrections was the same which I used in the first measurement of Mount Seward.

The detached thermometers, large and very sensitive instruments, were made by James Green. Each was carried in its case, carefully packed with cotton.

The large, compensated aneroid barometer was also my own. An azimuth or prismatic compass, telescopic spirit-level, with other numerous smaller instruments completed the mathematical equipments.

At some stations, where signals were required to indicate with precision the position of important points, red, white and black flags were employed. At others, more distant, cones of bright tin were used, so placed as to be given a slight vibratory motion by the wind. These, when the sun shines brightly, may be distinguished at a distance of several miles, sparkling like minute stars. Some of the mountain summits, however, whose relative position it was desirable to locate, were distant from the designed point of observation from fifty to sixty miles, and were, consequently, difficult to distinguish. It was therefore determined to attempt their location by the night observation of lights simultaneously kindled upon their summits. The oxy-hydrogen or calcium light, at first suggested, was rejected as entailing more expense than was warranted, and as impracticable. It was thought advisable to attempt the same result with beacon fires, and, in addition, ribbon or wire of the metal magnesium was procured, with the hope that the dazzling blaze which it affords while burning, would subserve the same purpose as the calcium light.

Copper bolts were provided for use upon five of the more important mountain stations, and sunk in holes drilled for their reception in the rock. Being of pure, soft copper, they will be almost indestructible by weather, and will serve to show the position of the theodolite in this survey to such other and further surveys as may be made. The words "Adirondack Survey," etc., in sunken letters are cut in the flattened heads of the bolts, together with the number of the station.

Bolt No. 1 is in the summit of Mount Marcy, the center of the mountain system, and of the great quadrilaterals of this triangulation.

Bolt No. 2 is in the summit of Whiteface Mountain.

Bolt No. 3 is in the summit of Owl's Head Mountain.

Bolt No. 4, intended for Crain's Mountain, Warren county, was not sunk; the station not being satisfactory.

Bolt No. 5 is in the summit of Bald Peak, in the town of Moriah, Essex county, near Lake Champlain.

* * * * * *

More than twenty experienced woodmen, or guides, were employed at different times during the season in carrying theodolite, baggage

and provisions. The lighter and more delicate instruments, sextants, barometers, etc., were carried by myself and assistants.

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The field work was commenced in the neighborhood of Lake Pleasant, Hamilton county, in the latter part of July. It was intended that, starting here, in the south-western portion of these mountain ridges which form the Adirondack chain, the triangulation should be advanced north-easterly, station by station, to Lake Champlain, and a perfect connection thus preserved throughout the survey. It was estimated that the leveling by mountain barometer and the topographical mapping could be advanced with the primary triangulation, thus avoiding the expense of more than one survey party.

Topographical reconnaissance was carefully made of the neighborhood of Lake Pleasant, several map sketches secured, and three triangulation stations made. On the 31st of July I ascended and barometrically measured Speculator Mountain, a prominent summit not to be found on any map, an assistant taking observations for corrections at the foot of the mountain.

In the preparation of reconnaissance maps of topography, several summits near Lake Pleasant were ascended and measured with the large aneroid barometer. Burnt Mountain * * Rift Hill * * Holmes Hill.

On the first of August, with three guides or packmen, carrying theodolite, provisions, etc., we left Lake Pleasant for Lewey Lake, an unsettled point, situated further in the forest.

There is some question as to the proper orthography of the title "Lewey." It is derived from the name of a Canadian Indian hunter, at one time a resident upon the lake shore. His name has long been written *Lewey*, and as the name thus spelt has appeared upon the State maps, it is best to retain it, and avoid hypercritical correction.

Near this lake arises a lofty mountain, which I had long regarded with interest. The best maps hitherto published show either leve ground or slight hills where it really arises to the clouds. Its measurement was desirable, for I suspected that it might be even higher than some of the famous Adirondack summits. In 1868 it first particularly attracted my attention from Lewey Lake. In 1870, I ascended and made a barometrical measurement of Mt. Emmons, or Blue Mountain, eight or nine miles distant from this peak, and found that instead of being 4,000 feet in height, as supposed by Prof. Emmons, it was really lower than his estimate, or about [3,824] feet above tide. From Mt. Emmons I was again surprised at the great height of the unmapped mountain thus towering where the maps show nothing but a plane, and, determined to visit it at the first opportunity.

It is known to the guides and hunters as Bald Face, or Snowy Mountain (the snow remaining on it late in the spring), and has also several other titles.

August second was stormy, but by noon on the third the weather improved, and gave promise of being fair enough for the work. Leaving an assistant to take observations at a lower station,on the shore of Lewey Lake, accompanied by two guides carrying theodolite and provisions, I started immediately on the ascent. We made a rapid march,

and passing over some subordinate mountain ranges, camped that night in a notch below the summit, near the edge of a precipice, which dropped sheer downward 100 or 200 feet.

Our camp was so elevated (3,686 feet), and the eastern precipice side of the notch so free from frost, that the sun, as it rose on the morning of the fourth, gleamed brightly in our faces, while all below was dark and robed in fog. We immediately addressed ourselves to the ascent, and early in the day reached the summit of the peak, which I shall hereafter term Snowy Mountain. The forest on the summit was in some places small and dwarfed, but was nevertheless too high to give a perfect view of the whole horizon.

A place being selected, the trees were chopped away by the guides, and the theodolite work commenced. As soon as the instrument was adjusted the telescope was turned upon Mt. Emmons, and the angle of depression, though slight, indicated that it was the lowest, after all due allowance for curvature of the earth and for refraction. The summit of Mt. Marcy arose sharply in the north-east, and was selected as the zero of measurement; and, as the day was beautifully clear, the angular work proceeded steadily, save slight intermission for barometrical observations.

Bread, without water, made our lunch, and at dusk we hurried as best we could down from the lonely crag, to be soon overtaken by darkness, compelled to wrap our blankets round us, and, making the tree roots pillows, there pass the night. The following day, hungry enough, we reached Lewey lake again.

The altitude of Snowy Mountain, by barometer, is [3,903] feet above tide, which renders it almost positive that this unmapped mountain is indeed higher than the famous Mt. Emmons. The synchronous observations of the assistant observer on barometer at the lake shore give for the height of Lewey lake [1,738] feet. This would make Snowy Mountain [2,165] feet above the lake.

Several reconnaissance maps having been completed and geodetic connection with the lake made, we passed, on the 6th, to Indian lake, the elevation of which, by barometer, is [1,705] feet.

The next undertaking was the exploration of the sources of Cedar river, about which much doubt existed. On one map a chain of ponds, which I had long known as the Cedar lakes (and which I had supposed were at the head waters of Cedar river), are shown as part of the West Canada lakes or sources of the West Canada creek, flowing westward. On another map, at this moment commonly sold to travelers of the wilderness, it is shown emptying into Moose river, under the name of Moose lake. These I knew to be mistakes, but it was important to prove them so.

Leaving Cedar River settlement on August 7th, we reached Cedar river falls the same day. The height of this station above tide is [2,135] feet. In the evening, altitudes of *Polaris* were taken with sextant and artificial horizon, for approximate determination of latitude. On the 8th Moose lake was reached, at the head of Moose river. From this point a lofty mountain, hitherto nameless, and of about the same altitude as Snowy Mountain, is visible at the south. The guides, in compliment, called it by my name. Proceeding about six miles further we struck Cedar river again, having crossed the great bend, and the same evening, following up the river, reached the Cedar

lakes, thus proving conclusively that they really discharged their waters to the Hudson river side of the watershed.

During this day's march through the forest we remarked, with wonder, that almost all the majestic spruce timber was either fallen and decaying or standing dead, so penetrated with dry rot and decay as to be crumbling to pieces. The same timber, only a few years since, was apparently sound and valuable. Now the lands on which they stand will probably not command ten cents an acre. This sudden decay of the forest is a most important matter to the owners of timber lands thereabouts, and deserves the attention of the botanist.

The night of August 8th was remarkable for an aurora borealis, which covered the whole dome of the heavens with a crimson canopy.

The morning of the 9th was devoted to topographical and barometrical work. The form of the Cedar lakes being approximately found by angles measured with sextant, by a forced march in the afternoon, we returned to Moose lake. The altitude of the Cedar lakes is [2,529] feet, and that of Moose lake [2,239] feet. Though the 10th was very sultry we marched back to Cedar river falls, and the same evening, in a furious thunder-storm, again reached Cedar River settlement.

The 11th was Sunday. One guide was paid off and returned alone, *via* Lewey lake, to Lake Pleasant. On the 12th we proceeded to Round lake where we encamped. The altitude of Round lake, by barometer, is [1,922] feet. The 13th opened stormily, but with an additional guide we struck into the woods to Long pond, a small and narrow sheet, whose elevation and position it was desirable to ascertain. Recent signs of bears were very abundant, the berries in the open glades affording them rich food. The lake, by barometer, is [1,960] feet, and the mountain near it has an altitude of [2,268] feet, both from tide. Soundings were taken in the lake and a reconnaissance map made. The sphagnum swamps in this neighborhood, though not very large, are remarkable for the beauty and depth of their velvety moss. Moving swiftly through forest and swamp, soaked with rain, we reached, late at night, a log hut occupied by a French or Canadian family.

On the 14th of August rapid progress was made, and, by way of Puffer and Thirteenth ponds, reached the village of North River. By barometer the elevation of Puffer pond is [2,229] feet, and that of Thirteenth pond [1,953] feet, above tide-level.

The guides hitherto employed were here paid off and discharged. It has rarely been my fortune to employ better or more reliable men.

August 15th we ascended South Mountain and made angular observations and one reconnaissance map. The height of the mountain, by the large compensated aneroid barometer, is [1,953] feet. The same day we drove rapidly to Johnsburgh, Warren county, and that night were at the foot of Crain's Mountain.

This mountain was thought, by the late Prof. Emmons, to be an excellent station if a triangulation of the mountains should ever be attempted, and I now designed making it the southerly corner of the great exterior quadrilateral of the survey. The morning of the 16th was cloudy, but with guide and packman I made the ascent of the mountain. Owing to a severe storm, which continued all day, we

were only able to make a barometrical measurement, from which the altitude of the summit has been computed at [3,289] feet; and owing either to the exposure to the storm or the roughness of the climb, had the mortification next morning to find that the barometers were all out of order. Their repair, with other reasons, necessitated our return, and we reached Albany on the following day. The barometers were taken to New York, where they were fortunate in receiving the personal attention of Mr. James Green, instrument maker to the Smithsonian Institute.

The preparations for the further progress of the survey consumed some six or seven days.

The barometers and other instruments having been placed in complete order, the necessary camp equipage, heavy blankets, rubber coats, etc., provided, we were prepared for the second expedition into the wilderness, which was to include the most arduous as well as the most important work of the survey.

It was proposed to make theodolite stations on the summits of two of the prominent mountains on the west shore of Lake Champlain, near Crown Point, and from each to take, as *zero*, the apex of the government light-house on that point; by that means connecting the stations with the United States hydrographical survey of the lake. As the positions of the light-houses on the lake have been determined with astronomical precision, they form an invaluable basis for work of this character. It was now intended to advance the triangulation westward from this point into the wilderness, and connect it with the angles already measured.

Reaching Port Henry, near Crown Point, on August 27, arrangements were made for the conveyance, and on the following day we proceeded toward Bulwagga Mountain, and selected, as the first of the sections, a summit lying a mile or two westward and known as Bald Mountain. The mountain to the northward, in the town of Moriah, known as Bald Peak, was selected as the second station. The Bald Mountain, from which the forest had long since been burned, afforded extraordinary facilities for the work of triangulation. As the altitudes were to be taken with mountain barometer, one assistant, with barometer, was detached and returned to the lake shore, as a near lower station, with orders to take observations at intervals of five minutes during the continuance of our party upon the mountain. Meanwhile, procuring a man to carry the theodolite, we ascended the mountain, which was steep and fenced with rock ledges and ghastly with crumbling trunks of burned trees. The summit gained, the first labor was to chop down and clear away a growth of young trees that obscured the view in one direction. The theodolite was then placed and adjusted, and the whole circle (clamped at zero) turned till the cross-hairs of the telescope stood with precision on the very apex of the distant light-house. The circle was now carefully clamped and the vernier plate being released, the telescope was turned upon the mountain summits westward, and angle after angle was carefully measured and re-measured, and recorded. The sky was clear and favorable, and the weather, which below had been extremely warm, was here cool and pleasant. Meanwhile an assistant had placed the mountain barometer, and sheltering it from the sun with a poncho thrown over a tripod of poles, took careful observations.

Late in the afternoon it became evident that another day would be required upon the summit, and the guide was accordingly dispatched for provisions and blankets. We continued at our duties until the sun slowly sank behind the mountains, the valleys filling with shadows, and Lake Champlain, from a glittering sea, was turned to a drear and gloomy waste. Darkness soon came upon us, and after a long and toilsome descent among the rocks and ledges, where it was almost impossible to see the way, the guide was met, returning with aid of lantern.

Camp was made beside a small stream flowing at the foot of the mountain, and the bright fire burning and plentiful provisions made our late labors trifling. Wrapped in blankets, the fire glowing at our feet, we passed the night, with no other roof between us and the stars than the slight swaying foliage of the trees.

The night was cold, but the morning of the 29th opened brightly, and propitiously for the survey. Again climbing the mountain, we resumed the occupation of the previous day, and in addition to the regular work I was able to take the angular direction of Mount Mansfield and the Camel's Hump in the Green Mountains. Reconnaissance maps of topography were secured, and we were able to descend and reach the farm house, some miles distant, before evening, having auspiciously opened the work on the eastern angle. The barometrical observations of the first day indicate that this mountain has an altitude of [2,302] feet. The height of Lake Champlain above tide, as indicated by the barometrical observations taken there and compared with the records of the Dudley Observatory, is ninety-one feet.

August 30th opened with a storm; the rain descended heavily, and while looking upon the low, gloomy clouds and fog with unpleasant forebodings, we could not but congratulate ourselves upon the completion of the triangulation work of this station. Packing our instruments, we took seats in a road wagon, and, amidst pouring rain and spattering mud, reached Port Henry again.

The light-house at Crown Point was next visited, and angular readings taken from the turret. It is an important station, as from its well established geographical position, the latitude and longitude of stations connected with it (and as is proposed with other light-houses) by this triangulation, will be known with more precision than by any astronomical method practicable in the field.

On the 31st of August the place of assistant Prescott was taken by Mr. James, and we immediately proceeded to Mineville, Essex county, in the neighborhood of Bald Peak, which had been selected as the second of the lake shore mountain stations.

The morning of September 1st was bright, the thick clouds which for several days past had been drifting between us and the mountain prospect had vanished, and we hastened to avail ourselves of so unusually favorable a day. The Bald Peak, like the Bald Mountain, our previous station, had been, at some distant period, deprived of its forest by fire; so long since, indeed, that large evergreen trees had grown near the summit. Those which obstructed the view were cut away.

As this was one of the five more important stations, the eastern angle, or corner of the great exterior quadrilateral of the survey, a copper bolt (No. 5) was securely fastened in the rock, and will show to future surveyors the position of the theodolite. The day was superb

and nearly cloudless, and knowing the fickleness of mountain weather all possible dispatch was made; and at sunset, although exhausted, we had the satisfaction of closing our field-books upon completed work. Mountain after mountain had been brought under the field of the telescope, and the horizontal angles, so carefully measured, exceeded sixty, nearly every one of which served to locate the direction of separate rocky peaks, many of which we had yet to climb, often with no sign to guide us through the trackless woods.

The usual barometrical altitudes were taken, and show for Bald Peak an altitude of [2,120] feet above tide; signal staff and flag were placed at the theodolite station.

On the following day (September 2d) we returned to Port Henry, and the same evening, by steamer on Lake Champlain, arrived at Plattsburgh. On the 2d we reached Wilmington village at the foot of Whiteface Mountain, which I had selected as the northern corner of the great quadrilateral, and which, it may be remarked, incloses the most mountainous and rugged portion of the wilderness.

Leaving an assistant at Wilmington as observer on barometer at lower station, we climbed the mountain, and shortly after dark reached "Rustic Lodge," on Whiteface; a log shanty now occupying my camping ground of 1869. The night was wintry, and the morning of the 4th showed the forest whitened with snow and ice. The altitude of Rustic Lodge, as taken with barometer, is [4,116] feet.

We were early upon the summit of Whiteface and had the instruments up and adjusted. The day was most unfavorable for triangulation. Heavy clouds drifted around and below us, hiding every thing. But, after a few dismal hours of waiting, the snow-white vapor lifted and suddenly we saw the rugged mountain crests, dark passes, blue gleaming lakes and sparkling ponds. Nevertheless, the clouds still hung around the central Adirondack peaks, and the summit of Mt. Marcy was long invisible. The constant drift of small clouds over the higher summits made the triangulation a slow and tedious labor, with more time fretted away in waiting than consumed in work. Two days were thus passed upon the summit.

At length all the angles had been measured; the Gothics, Marcy, McIntyre, Seward, Morris and St. Regis Mountains, with all the numerous summits intermediate in view, in the circuit of the horizon, had been located; even the corners and points of lakes, and the position of the prominent rude buildings of backwoods clearings far below, in the shadow of the deep valleys, were mathematically noted. Two signal flags were placed upon the summit and complete reconnaissance maps made; and two days' continuous duplicate readings of the mercurial mountain barometer, one set taken on the summit and one at the foot of the mountain, afforded better and more complete data for the determination of the height of Whiteface than any previously secured.

Whiteface first appears in print as having an elevation of 2,686 feet. This great error was corrected by the geological survey, and its height as given in the State Natural History is 4,900 feet above tide. My measurement confirms this result, and makes the height of the mountain 4,918 English feet above the sea.

We reached Wilmington, at the foot of Whiteface, in the afternoon

of September 6, and the same night, after a long and tedious drive, arrived at Lake Placid.

The seventh was devoted to topography and barometer work in the neighborhood of Lake Placid (which by barometer is 1,954 feet above tide) and in preparation for the more difficult labors of the survey. We were now again about to enter the great forest, having to make all further progress among the mountains on foot, all the baggage and heavy instruments being carried upon the backs of men. Provisions also, though plain and compact, formed a very considerable and weighty portion of the porterage.

The eighth of September was Sunday. On the ninth, after barometrical work in the neighborhood of North Elba, (from which the altitude of that place has been computed at 1,635 feet,) with three packmen carrying our heavier material, we crossed the Ausable river, and, entering the woods, took the trail for the Indian Pass. We camped that evening beside the brook along which I descended from the summit of Mount McIntyre in 1871, and building a shanty of boughs, passed a comfortable night. The altitude of this camp was 2,197 feet.

The morning of the tenth found us early upon the trail, and at the northern portal of the Indian Pass. Here a new camp was hastily made, and sending an assistant, with one guide, over the pass to the Hudson river side of the mountains, with orders to take barometrical observations at the south foot of Wallface Mountain precipice, (valley,) I took with me the other guides, and leaving the trail, proceeded to follow the main branch of the Ausable to its source. We were in hopes of finding some little lakes, known as "Scott's ponds" which, though doubted by some who had been unable to find them—Mr. Scott, their discoverer, having only seen them in winter, as level, snow-covered openings in the forest—were said to exist upon the top of Wallface, and which were probably the highest sources of the Ausable river. After a toilsome climb up the steep gorge of the river, wetted by the spray of many an unnamed waterfall, ascending slippery ledges by aid of rope-like roots, we reached less difficult ground, where the stream divided into a number of smaller brooks. These streams had probably been the means of bewildering previous searchers for the ponds; lack of woodcraft leading them to waste time in exploring to their source all the numerous brooks. Pushing forward we passed the clear, cold, spring-like streams, following, without hesitation, the more tepid and discolored water of one branch, which tasted like that derived from a pond or bog. Advancing in this manner, I caught the first glimpse of open water, which proved to be the largest of these high mountain ponds. It was small and apparently shallow. Several brooks enter it; one coming from two level moss-swamps which, in winter, had also probably the appearance of ponds. The altitude, by barometer, was found to be [3,091] feet, or higher than either Lakes Colden or Avalanche.

Leaving the pond we passed to the western side of Wallface, where the brooks trend to the Raquette, through Cold river, but finding nothing of importance returned, and wandering through the marshy forest, hazy with thick, bewildering masses of cold, driving clouds, had the fortune to stumble upon another lake, whose shores it is probable had never been previously visited by man. The altitude was greater

than the first pond, being [3,168] feet. It was a wild unearthly place, and to the subdued, muttered words of the guides, came the sudden snort of a deer as he fled from our approach.

In the afternoon we reached the summit of Wallface Mountain, measured it, observation for observation with the station in the abyss at the foot of the precipice, where the assistant was busily engaged. Afterward, descending to the verge of the cliff, observations were made to ascertain the greatest height of that tremendous monument and record of dynamical geology. The altitude of Wallface Mountain was found to be [3,893] feet, and the height of Wallface precipice 1,319 feet. One reconnaissance map was made. Moving with celerity we were able to reach our camp again, at the north portal of the pass, shortly after dark. This was the first of a series of movements in which the labor of several days was pressed into one, and in which the wilderness was shown to be traversable to skillful woodsmen by night as well as by day.

Next morning (September 11th) the whole party entered the Indian Pass, and after altitude observations at its center, which give for its elevation [2,937] feet, we passed beneath the dizzy crags, on the verge of which we had stood the previous day, and the same afternoon reached the deserted iron-works at Adirondack village. The day, as usual, had been one of storm and rain.

A slight delay was here necessary to enable us to replenish our supply of provisions from the slender stock of the single family residing in this lonely valley.

As the next station in the mountains was not more than seven miles distant, we took what provisions could be had, and at mid-day on the twelfth departed, notwithstanding the continuance of stormy weather; for I thought it best that we should be near our central station (Mt. Marcy), in order to take advantage of the first clear weather, if we should be so fortunate as to have any.

Reaching Lake Colden, a little after dark, we encamped on the north shore of the Opalescent river, which, during the night, swollen by the heavy rain, became a furious torrent. The party was accommodated in bark wigwams, each of which afforded shelter for two persons.

The next day the storm still continued unabated, and our chief occupation was to keep the apparatus from damage by water which soaked the floor, and dripped through the bark roof of the wigwams. A guide was sent back to the deserted iron-works for more provisions, for which we had made arrangements, (for we contemplated making this point a depot of supplies,) and another guide was employed in cutting down a large cedar tree, and hewing it into the shape of a canoe or dug-out for use in the mapping of Lake Colden, on whose waters no boat had hitherto floated.

The morning of the fourteenth was also stormy, but, upon the return of the man detached for provisions, immediate preparations were made for the ascent of Mt. Marcy. Baggage was reduced to a minimum, provision for the party for one day only being carried.

We were early upon the trail, but, with the heavy theodolite and fragile barometers, made a slow march. The weather continued so unfavorable, and consequently the probability of our being able to accomplish the work was so slight, that even the guides, who had now

acquired an interest in the survey, appeared discouraged. As hour after hour we ascended the foaming, rock-girt Opalescent river toward its source, the weather became colder and the thick clouds more disheartening.

It is not necessary to descant upon the climb. It was late afternoon, when, drenched with rain or cloud, that despite rubber covering had penetrated our clothing, we stood shivering in the gray, icy mist that swept furiously over the summit of Mt. Marcy. Benumbed with cold and unable to see for more than a few rods around, at the entreaties of the guides I reluctantly ordered an immediate descent, which was made upon the opposite or eastern side of the mountain. About a mile from the summit we found a level spot where water could be had, and decided to camp. Upon attempting to put up the tent we found our fingers so stiffened by cold that we could not button the canvas together, and the guides, after chopping some of the dwarfed timber for firewood, gave up in despair, and declared that we would "freeze to death" if we stayed there that night. Tent, baggage and instruments were again shouldered, and we descended the slippery rocks down and across the great slide on Marcy, toward the spot, two miles distant, where I had encamped last year, and where we hoped to find the bark huts still standing. Meanwhile the rain did not cease to fall, and it was dusk when, trembling from fatigue and exposure, we stumbled into the old camp in Panther Gorge.

The courage of our guides now returned. The timber was here large and good, and soon the echoing sound of chopping was heard, and the white chips flew from the trunks of the dead, dry, spruce trees. Huge logs of spruce and hard wood were quickly roaring and blazing, and we steaming before the fire in our soaked clothing.

All were so exhausted that, directly after supper, we wrapped our heavy army blankets round us, and fell asleep.

In the middle of the night the penetrating cold aroused us, and shouting for the guides to renew the fire, I saw with delight that the long storm had broken, for the sky was clear and the stars sparkled in the blue firmament. With the warmth of the fire came slumber again, only broken by daylight.

The morning of September 15th showed us that during the night we had received a visitor. Signs of panther had been numerous, but the new comer was a noble deer-hound, who had evidently, in following his prey into this most deserted portion of the wilderness, been lost. He was only too glad to join himself to human company. Our low stock of provisions made him an unwelcome visitor, but his evident timidity among strangers, and his determination in following in our track as we again ascended Mt. Marcy, won him friends.

The sun, which we had missed for so many days, now shone brilliantly over a cloudless landscape. Before leaving the timber a small tree was cut for signal flag-staff, besides some stouter ones for props.

The summit of the peak was early attained, and the barometrical work immediately commenced. The theodolite was probably the first ever placed upon Mt. Marcy. The day was so clear and favorable, so absolutely cloudless, as to be surprising; it seemed as though specially made for the work we had in hand. Thankful to the all-seeing Providence for this assistance, we did our best to take advantage of it, and

the triangulation proceeded without an instant being taken for rest or refreshment during the day.

At night, by observations of *Polaris* and *Alioth,* the true astronomical meridian was laid out, and the declination ("variation") of the magnetic needle determined. Though we kindled a beacon fire and burned magnesium ribbon, there was no visible response from the other signal stations, and the attempt at measuring the great angles by this means was consequently a failure. * * * *

The following morning (September 16th) work was continued until eleven o'clock, when a severe storm setting in, the tent was struck, and camp broken up. Taking with me one guide, I descended the south side of Mt. Marcy, with the intention of climbing and barometrically measuring Skylight Mountain and Gray Peak, and to visit a little lake lying in the chasm between the mountains.

The rest of the party returned by the trail to Lake Colden, where a series of barometrical observations were immediately taken by the assistant, at short appointed intervals during my absence. For ourselves the cloud was so dense that we could see nothing a hundred yards distant, yet we were able to reach the Gray Peak and measure it. About 4 P. M. we stood on the shores of the little lake, in a deplorable plight, our boots full of water and clothing torn and dripping The altitude of the Gray Peak, by aneroid, was found to be 4,947 feet. This little lake, by the mercurial (Green) barometer, has an altitude computed at [4,326] feet above tide. The little pond was a red-letter point in this survey, for we found it, as I had long surmised, not flowing to the Ausable, as has been represented, but to the Hudson river—an inaccuracy of the maps, which is perhaps the best proof that we were the first to ever really visit it.

Lakes Colden and Avalanche have been known, and still are known as the highest lake sources of Hudson river, being placed respectively, at 2,851 and 2,900 feet above the sea. This pond, with its elevation of [4,326] feet, will be interesting to the physical geographer. It is, apparently, the *summit water* of the State, and the loftiest known and true *high* pond source of the Hudson river.

Wet and chilled, we were forced to abandon for the time the attempt on Skylight Mountain ;. there was little chance also of valuable results being obtained in such a storm. Following the outlet of *Summit Water*, we made a hazardous descent through the ravine of Feldspar brook, reaching the shores of the Opalescent river about dark. The trail hence to Lake Colden, fair enough by daylight, proved full of stumbling blocks by night and occasionally we plunged into the crevices amid the rocks, with a suddenness, that threatened to break our limbs or fracture the barometer. We reached camp, however, without any accident.

September 17th opened with storm, and we determined to complete the canoe, or "dug-out," map Lake Colden and make soundings. Barometrical observations were taken by the assistant at the lake shore, while I gave my attention to theodoliting, by observations of the summits of Mounts McIntyre and Colden, connecting points on the lake, with the primary triangulation. The canoe was finished by nightfall, but required some slight touches before launching. The stray hound, which still remained with us, here made an onslaught on the provisions, devouring all the pork. A guide was sent for a fresh

supply, and was directed to lead the dog out and leave him. The hound, however, escaped on the way, and, running a deer to water, returned to our camp.

On the 18th, the guide sent out for provisions returned about noon, and the storm clearing off, late as it was, we started to ascend Mount Colden. This dangerous climb was one of the adventures of the expedition. It is the mountain from which sped the avalanche of 1869, that temporarily severed Avalanche lake, and is a rugged mass of rock, with precipice piled above precipice. We were able to make the ascent, measure it barometrically, do some triangulation, and secure several topographical or reconnaissance maps before dark. Of the dangers of the descent, finished at a quarter to eleven at night, I will not speak.

The following day, which was one of rain and heavy clouds, I launched and tested the canoe—named the "*Discovery*"—being the first boat of any kind ever placed on Lake Colden, and was surprised at the shallowness of the lake. The boat was then transported to Avalanche lake on which also no boat of any kind had ever floated, and I had the pleasure of the first sail upon that gloomy water. The canoe, though narrow, carried three men with ease—and more when balanced with out-riggers—and it enabled me to make soundings in different parts of the lake, and to examine the geological structure of the cliff walls, which fall directly into the water. This, with the barometrical leveling, engaged us to so late an hour that we had again to stumble along the trail in the dark, back to camp at Lake Colden. The canoe remains at Avalanche lake, and will render the Avalanche pass more convenient to travelers.

The 20th of September showed no abatement of the stormy weather, and as our provisions were again nearly exhausted, and the time which I had allotted for work in the neighborhood had passed, camp was broken up. With one guide I determined to descend the Opalescent river, and ascertain its course from Lake Colden downward.

Accordingly, I sent the rest back by the trail to the old Ironworks, by way of Calamity pond (elevation [2,712] feet) and taking all the provision—which was only sufficient for two meals, started. We were immediately separated from our companions and committed ourselves to the woods, during the whole morning continuing to follow the Opalescent downward. The clouds hung so very low that the summits of the mountain stations, and indeed of the inferior ridges, were invisible. The cold also increased and the wet bushes, from which the yellow, faded autumn leaves were now fast falling, gave a mournful appearance to the forest. At lunch we consumed half of our supply of food, reserving the remainder as a precaution, in case we should not be able, as intended, to cross the mountains and reach the old iron-works that night. The woods here seemed peculiarly wild, traces of game became abundant, and in one place we came upon the bones and fragments of a deer, which had been killed by a panther and torn to pieces.

Late in the afternoon we left the river and climbed the flanks of the mountains to the west. The clouds were so dense in the valley that nothing could be distinguished; but, compelled to hasten, we took our course by compass and pushed directly over the mountain ridges

toward the Hudson. In this way we became entangled in an almost impenetrable mass of fallen timber, a "wind slash," which probably extended over more than a thousand acres. Here, in clambering and crawling amidst the dead forest, which, crumbling and decayed, was a perfect chevaux-de-frise, after an hour or more of exhausting labor (the fog rising thick around us) we were compelled to acknowledge that we were lost. About dark, after crossing numerous hills and ridges, we succeeded in extricating ourselves from the slash. Below us was an almost precipitate steep of dark spruce woods. Seeing that we should have to camp, we descended and hastily searched for water. A rill was at length found, and the guide casting off his pack hurriedly proceeded to cut wood for the night. Our food all disappeared at supper, and we slept — one on either side of the fire, — on spruce boughs cast on the wet ground. Some wild creatures came around us at night, but we were too tired to pay attention to them.

The twenty-first opened with brilliant sunshine, yet as no well-known mountain peak was visible, we were as much lost as on the previous day. Breakfastless we resumed our march, and after climbing ridges, working our way through fire-slash, through swamp and through water, reached the Hudson and the old iron-works.

Here the guides, dissatisfied with the severity of the labor, demanded their discharge and asked increased pay; nor could they be persuaded to proceed further, exhibiting their torn clothing and soleless, gaping boots, as evidences of their inability. They were, accordingly, discharged, and returned on Monday, *via* the Indian Pass, to North Elba.

On Monday and Tuesday (September 23d and 24th), topography work was done in the neighborhood of the deserted iron-works and at Lake Sanford; repairs and preparations were also made for the further progress of the survey, two sub-expeditions having to be made from this point; one to Mt. Santanoni and one to Mt. Seward.

On the twenty-fifth we proceeded to Tahawus settlement, about ten miles distant, and secured packmen for the sub-expeditions.

Starting from Tahawus on the following morning, we reached the iron-works about noon on our way to Mt. Santanoni, which was to be one of the triangulation stations. In the evening we made a brush camp and passed a comfortable night. Next day (27th) we were early traversing the woods, (there was no trail nor were there choppings on the trees for guidance,) and following a small stream which came from the lofty crest, continued to ascend. The open character of the gorge we climbed, enabled me to apply my method of approximate measurement, by barometer and level, of inferior mountains, to several summits, as hereafter more particularly described, from which the height of Andrew mountain is found to be [3,216] feet, and North River mountain [3,758] feet.

We reached the summit of Santanoni about mid-day. Singularly enough, the weather, which for a day or two past had been threatening, was now moderately fair, and permitted the angular observations to be made very complete. Mt. Marcy, so often shrouded in the clouds, stood grandly out, a sharp, gray cone. The positions of various lakes and their islands were determined, and especially the lower end of Long lake, which, like a great river, lay stretched before us in

the west. Late in the afternoon the work was stopped by heavy clouds, but not until the necessary angles had been measured, the barometrical observations (showing its height to be [4,644] feet) finished, and five reconnaissance maps of topography completed. The sun was setting as we left the crest and forced our way down through the dwarf balsam and spruce trees on the flanks of the mountain. We had left all our heavy baggage in cáché a mile from the summit, beside the gorge up which we had climbed. For sake of food, camp-fire and blankets we hurried down in search of the gorge, and in about an hour found it, and commenced its descent just at dark. At length, very tired, we found our supplies, and by the light of a torch the guides cut night wood and built a hut of balsam boughs, the sound of the axe echoing desolately in the dark forest.

During the night the clouds disappeared, the stars shone out and a furious, cold wind swept over the woods.

Next morning (September 28th) we made a forced march, passing the camp of two days previous, and the same evening reached the old Iron-works.

The next sub-expedition was to Mt. Seward. It was advisable that this important mountain should be made a triangulation station, and I was also desirous of remeasuring it, having now an assistant with barometer stationed at the Iron-works, who would take synchronous readings at that place as a near lower station. My ascent of Mt. Seward in 1870 had been made from Long lake eastward, up to Cold river. We were now above the sources of that stream, and to reach the mountain's foot must descend Cold river, westward. The guides knew nothing of that portion of the wilderness, and placed upon my shoulders the responsibility, in addition to my scientific labors, of *guiding* them.

The twenty-ninth was very stormy, but in the afternoon we proceeded to the Preston ponds, at the head of Cold river, and encamped.

On the thirtieth, though it was still cloudy, we started early, and, by boat ,reached the outlet of the ponds. Here one guide shouldered the theodolite-knapsack and tripod, and the other the provision pack, and we proceeded down the river. There was nothing to guide us besides the stream and the compass-direction of the mountain, and the clouds grew thicker and more lowering, so that we could not even distinguish the foot hills. Crossing the river a few miles below the ponds, where a stream entered it on the north side, we ascended the ridge, in order to see whether any thing could be distinguished. Having climbed a tree, I suddenly noticed, in a valley below, a lake (unknown to the maps) which I remembered having seen from one of the ridges of Mount Seward in 1870. Supposing that we might have a glimpse of the mountain ftom the open shore of the lake, we went to it, but only gained a view of the lake and its surroundings. I named it White-Cedar pond, for the abundant growth of that tree upon its shores. We were compelled to diverge a quarter of a mile to reach the outlet, a small stream, and pressed on in the direction in which we thought Mount Seward lay. Presently commencing to ascend, we followed up a small brook, and continued to climb the mountain-side till we were lost in the clouds, and the general murkiness preceding night warned us to encamp.

Surprised at the apparent elevation of our resting place, I took

barometrical observations, which indicated that the altitude was [2,988] feet, which was rather surprising, as we could not yet have reached the slope of Mount Seward, and must, therefore, be upon the mountain eastward of it. This we called "Camp Somewhere," and went quietly to sleep.

October first was as cloudy as the previous day, and, without knowing any thing of our whereabouts (the denseness of the fog or cloud preventing our seeing even the forest forty rods up or down the slope), we concluded to keep climbing till we found at least the summit of the mountain on which we were. Hour after hour we continued slowly to ascend, still the summit was not reached. A barometrical observation showed remarkable altitude, and told me that we must either be upon the slopes of Mount Seward or of Ragged Mountain, the only high summits in this neighborhood. It did not seem as though we had gone far enough to reach Mount Seward, and I concluded that we must be upon the other, which, from the wild sort of precipice-climbing we had now to make, we thought had been justly named "Ragged." The thick, surrounding mist now began to brighten, and at length opened a vast view below of gaudy autumn woods, stretching away southward like a boundless sea. Then the clouds drifted from around us, and, rolling rapidly away, disclosed the superb mountain picture; showed us that we were indeed near the top of Ragged Mountain, and that there, darkly towering above the deep Ouluska pass (the home or *place of shadows* of the Indians) arose the black crest of Mount Seward. It was unmistakable. An involuntary "hurrah!" arose, and we pushed on for the summit of Ragged, for we had no idea of losing the results of our labor. We were soon on top and gazing down on Ampersand pond and the Saranac lakes, away to the north. Observation with the mountain-barometer on the spot gave Ragged Mountain an altitude of [4,163] feet. This was the "Mt. Seward" of those who had previously attempted the ascent. It was this mountain, also, and not the rear of Wallface, that I had seen in 1870, at the time of my first ascent of Mount Seward, forming the eastern wall of the Ouluska pass, as we had indeed noticed in 1871 from Mount McIntyre.

To reach Mount Seward, it was necessary to descend into the pass; and, as with difficulty we found a practicable place among the cliffs, we became more and more impressed with the grandeur of this gloomy gorge, so well named the "place of shadows." It is much deeper than the northern portal of the Indian pass, and having precipices on both sides, has a gloomier and more chasm-like appearance. Reaching the bottom we lunched beside a rill, and the barometrical height of the center of the pass was taken, since computed at [3,086] feet. As the elevation of Ragged Mountain is [4,163] feet, and as Mount Seward upon the other side rises still higher, it is probable that the Ouluska pass is more than 1,000 feet in depth. It is filled with forest, and the ledges on its cliffs are green with moss and stunted trees.

Signs of the panther were frequent, and it seemed that this remote place must be their favorite resort and home.

The summit of Mount Seward, the very spot which I had reached two years previously, was attained at about two P. M., and the theodolite and barometer were immediately placed. The clouds, however, settling around the mountain peaks, prevented triangulation; yet, in

addition to the barometrical observations, I found time to obtain reconnaissance maps. Though waiting till night, the clouds only grew thicker and colder, and at dark we hastily made camp in a ravine just east of the summit. The night was very dark and cold, and we constructed a hut of thick, evergreen boughs, facing the camp fire. The boughs were piled on the roof and sides of the shanty till they were a foot or more deep, and the heat of the fire warmed the open front. It was late when we enwrapped ourselves in blankets, but our sleep was sound, and I reluctantly opened my eyes, at the exclamations of the guides, to see large flakes of snow thickly falling out of the dark, frozen cloud, in which we were, sparkling into the light of the fire. Drawing our feet in from the snow, we slept again, only awakening with the gray of morning.

October 2d showed the summit of Mount Seward whitened with snow. Another series of barometrical observations were taken, and soon the temperature fell to +32° Fah. (or zero centigrade) so that the reduction to freezing point correction for these barometrical observations could have been omitted. The temperature fell even lower; the mean of thermometer this day being +32°.22 Fah. The height of Mount Seward, as computed from these observations, is [4,384.70] feet above tide. The instruments employed in this measurement were far superior to those used in 1870, and it is my opinion that the results are therefore more nearly accurate. My previous conclusions (Report on the Measurement of Mount Seward, Twenty-fourth Annual Report of the New York State Museum of Natural History, 1870) are, therefore, remarkably confirmed. The height of 5,100 feet, attributed to Mount Seward by Prof. Emmons, of the State Geological Survey, is thus proved to be in error some 600 or 700 feet.

At eight A. M., as there was no abatement of the storm, the cold growing intense, I reluctantly ordered the descent. Being short of provisions, and all anxious to return, we made almost reckless speed, yet did not reach Cold river till near midday. We struck it many miles below where it had been left two days previously. Though we followed it up stream for hours, with all possible rapidity and without stopping to rest, we came to no place where we had previously been, and at length were shut off from the river by high cañon walls, through which the deep, clear-green stream flowed sullenly below. We have named this the *Cañon of Cold River.*

We were compelled to encamp another night, but next day (October 3d) reached the Iron-works. The height of Lake Henderson was taken this day barometrically, and has been computed at [1,874] feet.

It was now late in the season, and much remained to be done in other quarters. We accordingly proceeded directly to the settlement at Tahawus or Lower Works, and on the morning of the fourth, by team, reached Rich lake, where boats and another guide were secured. The same night we camped upon the shores of Long pond, being upon our way to Long lake, via the Catlin waters.

On October 5th, Long lake was reached and the settlement midway upon it. The guides were here paid off and discharged, returning by boat and carry as they had come.

The sixth proving unusually bright and clear, with an assistant and a guide carrying the theodolite, I ascended Owl's Head Mountain and made the usual observations. This mountain is the westernmost

corner of the great quadrilateral, and the spot where the theodolite was placed is indicated by a copper bolt sunk in the rock of the peak.

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The seventh was stormy, but the absolutely necessary portion of the work had now been nearly completed. The relative positions of the great mountain landmarks, and of numberless intermediate points, had been fixed by the triangulation. It was now becoming wintry in this region, and it was almost impossible to get guides to visit the cold mountain summits. The assistant was accordingly sent out with the heavy instruments and baggage, and returned to Albany.

I remained to complete a hydrographic reconnaissance of Long lake, designing afterward to proceed westward to the Beaver river waters, taking the altitude of lakes by barometer and making such geodetic connection as might be possible.

October eighth was stormy; on the ninth, progress was made on the form of Long lake with sextant, the reconnaissance from the settlement to near the outlet being completed.

On the eleventh, with two guides, I started westward across the wilderness. One of the guides accompanied me but one day to assist upon a long carry. We reached Little Tupper's lake at dusk, and were hospitably received by a trapper camping on its shore. Barometrical observations were taken, and the altitude of the lake is computed at [1,737] feet.

From *Little Tupper's*, on the twelfth, we passed by way of Round pond, etc., to Tupper's lake, which is partially in St. Lawrence county. Barometrical observations were taken which indicate for the lake an altitude of [1,554] feet.

October 13th was Sunday, and was stormy. On Monday we proceeded with our light boat up Bog river, by the nine carries, or portages, to the Chain ponds on that river, and encamped. The guide knew nothing of this portion of the wilderness, and henceforward advanced according to my directions. It was now really the Adirondack winter; snow had fallen at intervals during the day, and this night, despite the roaring fire, we shivered in our blankets. Daylight on the fifteenth showed the ground covered with snow, and the evergreen forest gracefully drooping under the weight of feathery crystals. The altitude of the Chain ponds by barometer is [1,736] feet. About midday we reached Mud lake, long thought to be the head of Bog river. The barometrical observations taken here give the height of Mud lake and the elevated plateau on which it lies at [1,745] feet. The rest of the day was passed in a toilsome portage to Bog River pond; the boat being carried by the guide, and the instruments and baggage by myself. The distance has been called three miles. It certainly seemed longer, as in snow and slush, over hill and through swamp, we forced our way. Camp was made between Bog pond and Clear pond.

October 16th, after devoting some time to an examination of Bog River pond, we carried to Clear pond and thence to Harrington pond, crossing the divide of this portion of the watershed, and reached the streams which flow into Smith's lake and from the head waters of Beaver river.

On the seventeenth, it was my design to make a triangulation station on the summit of Smith's Ledge or mountain, on the west shore of Smith's lake, and this was the first bright and clear day that

we had had in more than a week. It was but a short distance from our camp to the ledge, and I was able to measure the horizontal angles between many of our major mountain stations, so that by a construction of the three-point problem, the angular position of this ledge, as measured by theodolite, from those mountains, could be verified, and the lake below and surrounding topography projected upon the map with direct reference to the base on Lake Champlain, more than seventy miles distant. The elevation of Smith's lake above tide has been computed from the barometrical observations at [1,774] feet. The height of the ledge or mountain above the lake may be placed at 498 feet.

Barometrical observations at Charlie pond, on the route to Little Tupper's lake, give its elevation above tide at [1,752] feet, making it fifty-two feet lower than Smith's lake.

It is to be remarked that if, at any future time, it should become necessary to have a greatly increased supply of water for the Hudson river or canals, even these distant lakes and rivers can be made tributary. The water of Smith's lake and of the lakes and streams emptying into it could be turned by a dam and canal into Charlie pond, which empties into Little Tupper's lake; by corresponding treatment, the waters of the latter could be led into Stony pond, which by the Slim pond empties into Long lake, and then by the dam and canal, long since proposed by Prof. Benedict, led to the head waters of the Hudson, nearly doubling the upper watershed of that noble river. In view of the proposed Champlain ship canal, this source of water supply may be of interest, but though the expenditure to render it available would be trifling, the consequential damages to mill owners in the settlements, on the lower waters of the streams thus diverted, would be considerable.

In leaving the wilderness, I proceeded down Beaver river, and from Lowville reached Albany.

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In November, late as was the season, it was thought advisable to attempt the completion of the angular measurements from the one or two stations which remained unvisited. As soon as the disease (epizootic) among the horses — which had rendered travel beyond railroads almost impossible — had abated, work was recommenced. The angular measurements from the southern corner of the great quadrilateral had been left till the more difficult work, in the interior of the wilderness, had been accomplished. Crain's mountain, in Warren county, which had been selected and ascended for this purpose, had proved unfavorable, and Mount Moxon or Maxham, north-eastward of it, had been selected as its substitute.

November 14th found me in the neighborhood of Mount Maxham, with theodolite, barometer, etc. On the morning of the fifteenth, accompanied by a guide carrying the theodolite, and a volunteer assistant, we set out for the mountain, some five miles distant. The snow in the woods made the walking uncomfortable, but about noon we reached the foot, and after a short rest, commenced to scale the precipitous front. At this time it was slippery with snow and hung with icicles, and consequently dangerous. After laboriously approaching the summit, we found ourselves in a cul-de-sac on the face of the cliff — the rocks overhanging — and were compelled to descend a dis-

tance and try another ledge, where, happily, we were more fortunate, and attained the crest. The theodolite was placed and angular measurements made, but the intense cold (+25° Fah., or seven degrees below zero centigrade) with the sweeping wind, prevented complete work. A reconnaissance map was made, and from the barometrical observations taken I have computed the height of this station at [2,510] feet.

It was after 3 P. M. when we left the summit, and so dangerous was the descent that it was nearly sunset when we reached the foot of the precipice. It was the intention to have proceeded from this station to Ticonderoga, where another triangulation station would have been made on the summit of Mount Defiance; but the horse disease — which had ceased in the cities — was here at its height. It was almost impossible to procure conveyance, and the survey was brought to a summary conclusion.

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The recording barometer will, I have faith, be yet generally made the standard in hypsometry. If, in the course of a barometrical survey of the Adirondack region, superior instruments of this class, or the meteorographs of Prof. G. W. Hough, were placed at different stations on the borders of the region; Crown Point, Plattsburgh, Ogdensburgh, Lowville, Utica, and centrally at Adirondack village, and their records compared with observations taken at different points of the wilderness, most interesting results might be expected. It is not too much to say that the mean of such a series of comparisons would indicate the altitude of interior stations with as great accuracy as is economically possible.

In the interests of meteorology and advanced science, I cannot too strongly urge the erection by the State of a small stone hut or hospice, near the summit of Mt. Marcy, to afford shelter, from sudden, severe and dangerous storms, to scientific observers. It would be of great interest to determine the maximum and minimum temperature, etc., by recording instruments left at such a station during the winter. The knowledge that such a protection against storm existed, would induce more tourists to visit the summit, and well repay the small expenditure, by bringing thousands of dollars into the State annually, which would otherwise be elsewhere expended.

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Upon the map-sketch of triangulation will be found a blue line, which indicates approximately the position of the summit of the watershed of the Hudson, or the divide between its sources and the waters which flow to the St. Lawrence river. This is a matter of interest in connection with the canals and general water supply. It may also be of value in the determination of the area of forest which it is necessary to preserve in order to protect from evaporation the springs and streams which are the sources of the Hudson.

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The results of the survey are numerous and interesting. The vastness and wildness of the region is the better appreciated when, at this late day, we are able to find within it mountains from 3,000 to 4,000 feet in height, nameless, unascended and unmeasured. The incorrectness of the existing maps is understood, when we discover that the famous Blue Mountain or Mount Emmons is not 4,000 feet high (as

represented), and that it is apparently inferior to the lofty neighboring summit known as Snowy Mountain, which rises to an altitude of [3,903] feet, where on the maps is shown a blank.

Again, while geographers have expatiated upon the great elevation (for this region) of the lakes Colden and Avalanche, in Essex county, a little more than 2,700 feet above the sea, they have gone blindly on, unaware that far in the south portion of the woods, the Cedar lakes — from whose shores the snows of winter depart slowly — lie, on the great and most elevated plateau of the wilderness, at an elevation of [2,529] feet; not flowing to the St. Lawrence, as represented upon their maps, but to the Hudson river.

As a matter of technical geographical interest, the discovery of the true highest pond-source of the Hudson river is, perhaps, more interesting. Far above the chilly waters of Lake Avalanche, at an elevation of [4,326] feet, is *Summit Water*, a minute, unpretending tear-of-the-clouds — as it were — a lonely pool, shivering in the breezes of the mountains, and sending its limpid surplus through Feldspar brook to the Opalescent river, the well-spring of the Hudson.

But I may not enlarge upon these subjects. In the hasty journal of the survey, and in the tabular statements of altitudes taken by mountain barometer, will be found a great number of new results.

Many mountains still remain barometrically unmeasured, though their altitude may be trigonometrically computed. Mt. Dix and Mt. McIntyre, though they have been previously ascended, are among the number unmeasured. The appropriateness of the new names Mt. Redfield, Mt. Street and Mt. Adams, given to summits hitherto unnamed, will be appreciated by those acquainted with the written history of the region.

It is now a question of political importance whether the section covered by this survey should not be preserved, in its present primitive condition, as a forest-farm and source of timber supply for our buildings and our ships. The deprivation of a State of its timber is a grave error in political economy, and at this time when the western States of the Union, feeling their deficiency, are laboriously planting forests, it behooves us to see to the preservation of those with which we are spontaneously blessed.

The question of water supply, also, is intimately connected with this proposition. I have elsewhere expressed my opinion that within one hundred years the cold, healthful, living waters of the wilderness — the home of the brook trout, a fish that cannot exist in an impure stream — will be required for the domestic water supply of the cities of the Hudson River valley. With the exception of the Croton watershed, which, however, has its limits of supply, almost all the available water falling into the Hudson below Albany is the surface drainage of a settled and well-farmed region, inferior in quality, often charged with the deleterious products of paper-mills and factories; being, in short, from watersheds over which the public has no control. It is not possible to protect from defilement the waters flowing through a settled country. Every storm washes the fields and carries to the streams, in solution, the strength of the manures of the agriculturist and much dissolved mineral matter derived from the plowed soil of the fields. The trees also are cut away to the water's edge, and the shallow streams, lacking the volume and depth, which, in great rivers, renders

the exposure of the surface of the water to the sun a mere superficial and immaterial matter, now, heated and evaporating, become nauseous and slimy with a growth of decaying vegetable organisms. The streams of the wilderness, on the contrary, are sheltered from the sun by the thick overhanging foliage of the forest. The more extensive underlying rocks of the region being generally gneissoid, contain little soluble matter; and the pure water from the clouds, after gaining carbonic acid by exposure to the air in the breezy lakes, comes brightly foaming over many a picturesque rapid and waterfall to the Hudson and the sea. A stone dam thrown across the Hudson above its junction with the Schroon, while securing water free from deleterious substances, would afford the head of water necessary for aqueduct purposes; the superfluous waters of the river escaping at the center of the dam, through a flume, would be sufficient for the purposes of the lumberman or the "river driver." The Sacondaga river above Northville is pure and of great value, and could be treated in the same manner.

The great expense attending this project is the aqueduct, which, if extended to New York city, would be more than 200 miles in length. When we consider, however, the Roman aqueducts (the *Aqua Marcia*, sixty miles in length, built 145 years before Christ, and the numerous other aqueducts, some of which are in use to this day; the aqueduct of the inferior town, *Civita Vecchia*, twenty-three miles in length; in Provence, that which supplied Nismes, crossing deep valleys at a height of 188 feet, conducting the water for a distance of twenty-five miles), the aqueduct proposed will not appear chimerical.

In Scotland, the city of Glasgow is supplied with water brought from Loch Katrine, distant twenty-six miles; furnishing 19,000,000 gallons a day. This aqueduct was completed in 1858.

In France, a covered conduit, eighty miles in length, conveys to Paris 8,000,000 gallons of pure spring water, daily, from the head of the Dhuis, in Champagne; and progress is being made upon the Vanne aqueduct, 104 miles in length; estimated to yield 22,000,000 gallons a day.

In England, the water furnished London being inferior in quality, a new source of supply, from the head waters of the River Severn in North Wales, distant 173 miles, has been suggested. The cost of the aqueduct is estimated at about $43,000,000.

All these works are undertaken for the sake of procuring *pure water*, for, though each of the cities above mentioned has a river flowing past it, from which water could be obtained by steam pumps, the people of those cities are not satisfied, and demand such a *pure* supply as will secure them from cholera and other epidemics.

If the present ratio of increase of population continues, the Hudson River valley must eventually contain one long, marginal city, extending from the Mohawk river to New York. The Adirondack Wilderness is the only watershed which will afford a sufficient supply of pure water for such a population as will then exist.

In this country the Croton aqueduct, thirty-eight miles in length, has shown the practicability and value of this method of supply. Allowing that 150 miles of the proposed Adirondack aqueduct be built at the expense of the cities of New York and Brooklyn, and fifty miles at the expense of Albany and Troy, we have the major portion

of the work complete; while ten other towns, each worthy of an aqueduct ten miles in length, would render their aid to the enterprise. Although this source of water supply cannot, for various reasons, be made immediately available, yet, unless action be taken at this time, and the forests protecting and purifying the waters be themselves protected, there will be no opportunity in the future to accomplish this great work.

Such vast enterprises are of slow progress. If this aqueduct were commenced in these days, long before its completion the failing water supply, would rouse the people to a clamorous demand that it be finished. For the present, the protection of the forest is all that is required, and unless this be done we shall incur the merited scorn of posterity.

In consideration of the hardships and exposure experienced in this exploration, it may be proper to remark that not a particle of alcoholic or fermented liquor of any kind — even for medicinal purposes — was used, carried or permitted to be used or carried by any member of the party. It was a rule against which some of the men employed murmured, but they were only able to break it surreptitiously. The result has been subordination, steady work, health and success.

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VERPLANCK COLVIN.

ALBANY, *March* 10*th*, 1873.

APPENDIX E.

TITANIUM IRON.

For the information of those who are interested in the subject of iron manufacture from titanium iron, I annex the following extract from a report of Prof. J. P. Lesley, State Geologist of Pennsylvania, upon the " Titaniferous Iron Ore Range, of North Carolina," page 29:

"THE ACTION OF TITANIUM.

" Although this is an obscure subject, something is known of it by actual experience.

" J. H. Alexander, of Baltimore, in his report on the manufacture of iron, gives analyses of certain cinders, among which is one obtained in the smelting of a primary iron ore, containing, he says, 11 (eleven) per cent titanic acid. The analysis is as follows:

" Silica.............	31.1	*Oxide of Titanium*....	9.0
Magnesia...........	34.2	Protox. manganese....	4.4
Lime...............	14.1	Protox. iron..........	1.0
Alumina............	8.9		

" The ore, he says, was hard to smelt, and the pig-iron hard to work, but when properly made, is peculiarly adapted to the manufacture of steel.

" The explanation is as follows: Titanic acid will not combine readily with either the acid or the alkaline oxides. In every ton of ore (holding ten per cent of it), 320 lbs. of this neutral stuff exists, or ($1\frac{1}{4}$ tons of ore to 1 ton of iron), 330 lbs. of it in every ton of iron. If only $\frac{1}{10}$ of this (or 33 lbs.) remains in the furnace, the gradual accumulation blocks it up. The only solvents of it are the double silicates of iron and lime, or iron and alumina and lime, or iron and potash and lime, etc. To make these double silicates, we must *waste* a good deal of iron. But the one object of the blast furnace is, to save all the iron, and the best cinder is that which has no iron left in it, all the iron of the burden having gone down into the hearth as pure metal (with enough carbon to make it fusible). The Catalan forge, on the contrary, wastes iron; and its cinders are so rich in iron that they are often worked over again; hence, titanic acid is carried off, and does not obstruct the hearth. The forge fire is, therefore, the best to reduce titaniferous iron ores. But the blast furnace can smelt them, also, if the heat be kept low, and some of the iron be allowed to go to waste

in the cinders, to carry off the titanic acid and cinder mass. The object, then, must be to make the utmost quantity of the most fusible cinder; therefore, a blast furnace running on titaniferous ores, should not be fluxed by pure limestone, pure clay or pure sand, but with ferruginous clay, ferruginous slate or ferruginous limestone. These fluxes will dissolve titanic acid *at a low heat.* To get gray pig-iron, the cinder must be abundant; to get white forge metal, but little flux is needed in comparison, the ore itself being wasted to form cinder. This *white iron with a large amount of carbon in it,* is just the metal from which German steel is manufactured. A high stack and a small hearth, like the Styrian furnaces, and ferruginous fluxes, are the best for titaniferous ores."

The method of John Player for the treatment of Norwegian ores, is also referred to, and is said to be "successfully used at Norton, England, although they contain by one analysis:

"Titanic acid		40.95
Per. ox. iron	22.63	51.59
Protox. iron	28.96	
Magnesia	4.72	7.81
Alumina	2.11	
Silica	.42	
Protox. mang	.56	
		100.35

being smelted in small furnaces with 1,000° Fah. temperature of blast, 2 tons of coal to 2¼ tons of ore, 15 cwt. of limestone, 10 cwt of basalt rock."

"'The iron becomes titanized, and is found to be exceedingly strong, and is used in Europe for armor plates, commanding *three times the price* of ordinary pig-iron. The tensile strength of the resulting wrought iron, when puddled, is about 52¼ tons to the square inch. There is very little carbon in the pig-metal produced, and *being almost steel,* in puddling it requires but half the time of ordinary pig-metal.'"

"*Muchats steel* is a titanic iron, with the peculiarity of being sufficiently hard after being heated red hot and forged, not to require tempering, but is comparatively brittle. Its color is not white, but has a tinge of straw color, light brown."

A series of analyses and notes, practical tests of the North Carolina titanic iron, are given in the same paper, which I commend to the perusal of those interested.

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